SCIENTIFIC AMERICAN

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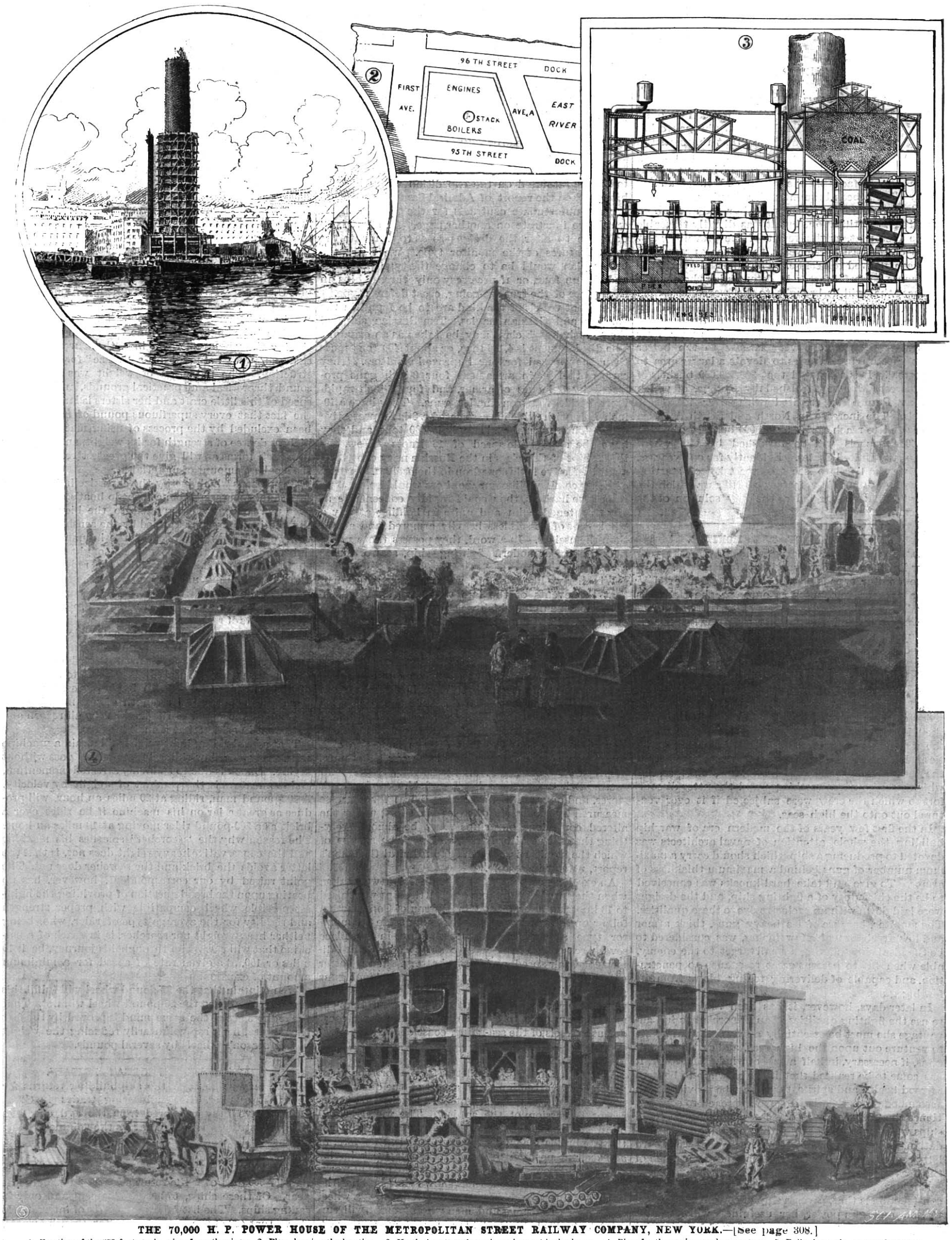
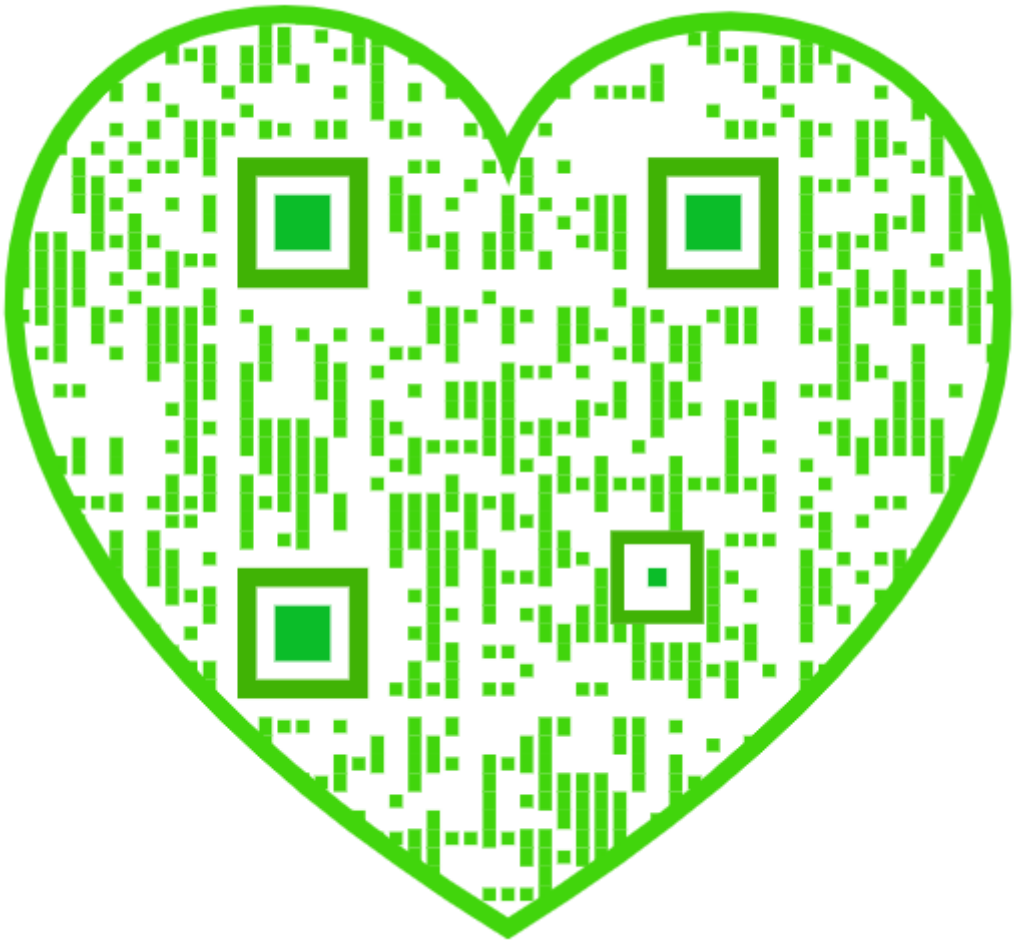


THE 70,000 H. P. POWER HOUSE OF THE METROPOLITAN STREET RAILWAY COMPANY, NEW YORK.—[See page 308.]

1. Erection of the 358-foot stack—view from the river. 2. Plan showing the location. 3. Vertical section through engine and boiler house. 4. Piers for the engines and generators. 5. Boiler house in course of erection.



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NEW YORK, SATURDAY, NOVEMBER 12, 1898.

THE WORLD'S WHEAT SUPPLY.

At the time of the delivery of Sir William Crookes' address, in which he predicted a scarcity in the world's supply of wheat, we pointed out that the statistics upon which his estimate was based were in many respects unreliable. The shortage of last year was due, not to the fact that the wheat-producing land had nearly all of it been brought under the plow, nor to the fact that the land was becoming exhausted and calling for artificial fertilization, but it was directly traceable to the fact that, as the result of the prevailing low prices of the past three years, the wheat production had been allowed to decline. The financial question is a far more powerful factor in determining the amount of wheat that will be brought to the warehouse each year than any of the causes named by Sir William Crookes. Evidence of this is seen in the increase of over 300,000,000 bushels of wheat this year over the supply of 1897, due very largely to the better prices encouraging farmers to devote a larger area to this cereal. It is estimated that 236,000,000 bushels of this increase will be furnished by Europe, of which amount France is credited with over 100,000,000 bushels. The increase in North and South America is expected to reach about 90,000,000 bushels, of which 60,000,000 bushels will be furnished by the wheat fields of the United States. Evidently for one year, at least, we shall fail to see the necessity of starting the mammoth fertilizer factory at Niagara which the learned chemist suggested as the only solution of the problem.

THE PASSING OF THE MONITOR.

That Congress should have authorized in the year of our Lord 1898 the construction of four new warships of the monitor type is proof of the fact that even in such a progressive country as our own, the trammels of tradition and the mere spell of a name are powerful and controlling influences; for beyond the fact that it is a purely American invention, which in the very infancy of ironclad construction did excellent work, there is practically nothing to justify its existence in this advanced age of warship construction.

The "Monitor," Ericsson's original creation, was built for service in the shallow and sheltered bays and rivers of the Southern States, and in the battle with the "Merrimac" and the later naval engagements of the war, the type proved its splendid fighting qualities. From the first, however, it was evident that the monitor had its strict limitations, chief among which were its unseaworthiness and the utter discomfort to which the crew were subjected if it ever ventured out onto the high seas.

In the first few years of the modern era of warship building, the whole attention of naval architects was devoted to producing a ship which should carry a maximum number of guns behind a maximum thickness of armor. To give and take hard knocks was conceived to be the chief duty of a fighting ship, and the designs were laid down with an exclusive eye to these qualities. The monitor, because of its heavy guns, thick armor and low freeboard of a few inches, was considered to be the ideal ship, offering a small target to the enemy, able when hit to present great resistance to penetration, and capable of delivering telling blows from its few big guns.

In later days, however, it has been recognized that to use the fighting qualities of an armorclad to full advantage she must be essentially a seaworthy ship, able to venture out upon the high seas, and cast loose her guns, if necessary, in half a gale of wind. Moreover, it has come to be realized that if the crew are to be kept in good health and spirits, they must be provided with accommodations that have some approach to comfort. Hence the tendency in all the later designs is to build ships with high freeboard, providing ample accommodation, and mount the guns upon decks that will afford lofty and stable platforms, well up above the reach of the heavy seas.

Another fundamental truth that governs all later construction is that, given a ship of certain armor protection and gun power, her usefulness will vary directly as her speed.

Now, judged by these standards, the monitor is a decidedly obsolete type. She is not seaworthy—the very first monitor foundered off our own coasts—she dare not cast loose her guns in even a moderate sea, and, if she did, she could not, because of her quick rolling, hit anything; her accommodations are so cramped as to be extremely uncomfortable at any time and simply intolerable in the tropics; her low freeboard allows the green seas to roll bodily across her main deck and practically drown out the big guns; instead of her guns being carried well above the waterline, they are so near it that in a moderate sea the gunners cannot even see the enemy when the vessel is in the trough of the waves; their speed is low, five knots being all that Admiral Sampson was able to get out of the monitors that hampered his squadron in the Porto Rico operations; and finally, because of their small coal capacity, they dare not venture unattended to any great distance from a friendly base.

The actual experiences of war have gone to prove what has been for a long time anticipated by naval experts, and the inefficiency of this class of vessel is clearly set forth in the official report of Admiral Sampson (see report in current issue of SCIENTIFIC AMERICAN SUPPLEMENT.)

Secretary Long and the Bureau of Construction are to be congratulated on the expedition with which he has acted on the report of Admiral Sampson in revoking the unfortunate contracts for the four monitors, which we illustrate on another page. An effort is to be made to alter the designs so as to eliminate the worst features of the monitor type. We think the better plan would be to change the type altogether and design four, or if necessary only three, ships in their place of the true sea-going, coast defense type.

Excellent vessels of the kind are to be found in the Russian and German navies. The Russian ships of the "Oushokoff" class may be taken as an example. The displacement is 4,126 tons, or about 400 tons more than is proposed for our improved monitors. They carry as their main armament four 9-inch guns protected by 8 inches of armor, and four 6-inch rapid-firers, besides fourteen smaller guns. They have a 10-inch belt with which is associated a 3-inch protective deck. Their normal coal supply is 400 tons, and they have the serviceable speed of 16 knots. Now, the three ships of this class in the Russian navy constitute a most effective little squadron in themselves. Instead of being confined, like our monitors would be, to their respective harbors, they could rapidly concentrate at any threatened point and unite in holding at bay a whole fleet of vessels less heavily armored and armed than themselves. In a word, they possess those prime requisites of a modern fighting ship, seaworthiness and speed.

Whether we like it or not, we must accept the fact that the events of the late war have changed the whole scheme upon which we started out to build up our navy. Fifteen years ago the keynote to our naval preparations was "self-defense." We were careful to call our first three line-of-battle ships coast defense vessels. Cuba and Porto Rico were not in our thoughts and Manila Bay existed for us only on our maps and in our books of geography. Now, however, we are committed to a policy which demands that our navy shall possess above every other quality that of mobility. Our ships must be capable of steaming far and fast; we must realize that the best defense is that which commences at the enemy's coastline; our ships must be prepared to cut loose from the friendly shelter and succor at home ports and go far afield, carrying coal, stores, and ammunition, such as will last for a cruise measured by thousands of miles—in short, under the altered conditions, our ships must be almost everything that the monitor is not, and perform service of which the monitor is, according to Admiral Sampson's report, utterly incapable.

An excellent step in the right direction was taken when the speed of the three new battleships was raised to 18 knots an hour. Let the Bureau of Construction follow up the good work by throwing aside the monitor type altogether, and substituting in its place several sea-going, coast-defense ships of moderate dimensions, fair speed, and heavy battery. What better use could be made by the navy of the 13-inch guns already built for the "Alabama" class, but to be replaced, we hope, by the new 12-inch gun, than to mount them (two to each ship) in half a dozen coast defense vessels of the sea-going, coast defense type?

THE LIGHT-WEIGHT BICYCLE AGAIN.

We publish in this issue a letter from a correspondent which draws attention to an aspect of the question of bicycle weights which has not been touched on in the recent discussion of the subject. The writer is well qualified to speak on the question by virtue of the fact that he builds machines to order, and is, therefore, in an excellent position to judge of the relative behavior of light and heavy wheels of the same quality of workmanship. His experience has shown that it is not the heavyweight rider who taxes the strength of a wheel so much as the boys and men whose weight will run from 75 to 125 pounds. This apparent anomaly is explained by the fact that only a small percentage of the heavyweights are hard riders, the latter class being made up of boys and lightweight men, who "rush along over rocky roads with a reckless, don't-care-if-I-do-fall spirit." It is these riders, in the opinion of our correspondent, who are answerable for the present increase in the weight of the bicycle.

We are quite agreed with the writer that the breakages of machines are generally attributable to rough usage, and, in advocating a return to lighter construction, we had no intention of championing the cause of that reckless and altogether objectionable species of rider for whose designation it has been necessary to add a new word to the English vocabulary. In asking for a return to reasonable weights—and no one, surely, will affirm that in these days of high grade steel 27 to 30 pounds per wheel is reasonable—we are simply demanding that the average rider shall not be obliged to carry around with him from 6 to 8 pounds of superfluous weight, which has been worked into the machine simply because a heavy machine can be built more cheaply, and in less time, than a light one.

Some of the bicycle trade papers that have found fault with our advocacy of lighter machines have spoken of the discussion as a return of the "craze" for lightness; thereby suggesting that the desire to reduce weight is merely a fad and not based upon sound scientific principles. As a matter of fact, however, both the principles and history of mechanical engineering are behind the wheelman when he protests against the increasing weight as being a distinctly retrograde step. In every branch of engineering there has been, and is to-day, a steady reduction in the weights of all classes of machinery and construction. The engines of the old U. S. S. "Powhatan" weighed 867 pounds per horse power, whereas the engines of the torpedo boat "Ericsson" develop a horse power for every 50 pounds weight of the engines. No one will affirm that, in designing the "Ericsson's" engines, the Bureau of Construction were actuated by a "craze" for light construction. The reduction of weight was sought on sound theoretical and practical grounds, and the high speed of this little craft and her sisters is largely due to the fact that every superfluous pound of material has been excluded by the process of using material of the highest degree of strength for its weight, and disposing it in such forms as will give the greatest resistance for the smallest amount of material.

The reasons which justify the careful elimination of superfluous material from a torpedo boat's engines are even more cogent when applied to the bicycle, where the motive power is supplied by the sensitive and too easily overstrained organism of the human body—the only difference in the two objects sought after being that, in the torpedo boat, weights are reduced with a view to obtaining more speed with the same power, while in the bicycle the object is to secure the same speed with less power. Taking duly into account all the elements of resistance due to the machine, the roads and the weather, in propelling a bicycle, it may be said that the work done on a day's journey, as far as the wheel is concerned, is the product of the weight by the distance traveled; and if it is possible to reduce one of these factors (the weight) by 30 per cent, without impairing the needful strength of the machine, we claim that the wheelman is justified by all reason and precedent in asking that it shall be done.

That a hard-riding lightweight will strain a machine as severely as a slow-riding heavyweight, goes without saying. Shock is due to suddenly arrested momentum, and momentum is the product of weight by velocity. A 100-pound man, riding at 20 miles an hour, will produce as great a jar on his machine if he rides over a brick as a 200-pound rider moving at 10 miles an hour. The reason why the "scorcher" smashes his machine and the conservative heavyweight does not, is that the latter avoids the brick and the scorcher does not. The point raised by our correspondent, however, has no bearing upon the broad question of providing the lightest possible wheel compatible with proper strength and rigidity for the average type of rider, who, being neither heavyweight nor scorcher, is in seach of a machine that will carry him through his journey, be it 10 miles or 100, at a given rate of speed for a minimum amount of exertion.

We maintain that the 22-pound wheel will fulfill this condition and that the 29-pound wheel will not. That the makers are of the same mind is proved by the fact that several firms are voluntarily reducing the weight of this season's wheels by several pounds.

SHIPBUILDING IN GREAT BRITAIN.

If we may judge from the shipbuilding returns for the past quarter, the engineering trades in Great Britain have fully recovered from the evil effects of the great strike, at least as far as the volume of trade is concerned. The various yards had under construction no less than 598 merchant vessels, with a gross tonnage of 1,364,250 tons. This is an increase of 143 vessels and 480,000 tons over the returns for the same date last year. Of these ships, 572 were steamers and only 26 sailing ships. The list of customers is of interest. It shows that 492 of the vessels were for British owners.

while 6 were to go to the Colonies. Germany had ordered 8 of the ships, aggregating 47,700 tons, and Russia 11 vessels, of 26,480 tons. Then in their order come Japan, 11 ships; Norway, 9 ships; Holland, 6; Denmark, 6; and Austria-Hungary, 3 ships. The vessel of large displacement is growing in favor, for the tables include 6 vessels of over 10,000 tons, 7 of from 8,000 to 10,000, 39 of from 6,000 to 8,000, and 57 from 4,000 to 6,000. There are 124 steamers, chiefly of the "tramp" class, of a tonnage varying from 3,000 to 4,000.

To these figures must be added those for warship construction, which show that 58 ships, of an aggregate displacement of 265,800 tons, are being built for the British navy. There are also 34 warships aggregating 110,635 tons, being built in private yards for foreign powers. Of this tonnage, the great Elswick yard, where a cruiser, the "Albany," is now completing for our government, is building 64,000 tons, or more than one-half. Adding the totals for warships to those for merchant vessels, we arrive at an aggregate of 690 vessels, representing the enormous total of 1,740,685 tons under construction. This, we believe, is the high water mark in the history of this industry.

PROPOSED CHANGE OF MOTIVE POWER FOR THE FOURTH AVENUE TUNNEL.

The practicability of using some other power than steam, with its attendant smoke and cinders, for drawing trains through tunnels has become so apparent during the closing years of this century that it is particularly gratifying to note the early change of power determined upon by the great railway systems having the Grand Central Depot in this city for their terminus.

Daily, at frequent intervals, trains drawn by large locomotives pass through the underground tunnel road stretching from Fifty-seventh Street north to about Ninety-sixth Street, keeping the atmosphere therein more or less continually surcharged with gas and smoke most disagreeable and unhealthful to passengers.

This useful section of road, equipped with substantial rails and a double set of signals, is about to be transformed into a road over which it will be a pleasure to ride.

It is proposed to draw trains over it either by means of compressed air locomotives or by electric power and to illuminate the tunnel sections by the electric light.

It is probable trains will be hauled by this means as far as the Mott Haven yards, where the steam locomotive will be used to continue the journey.

We trust this improvement, practical and feasible as it is, will take place speedily, that the traveling public may obtain relief from the existing annoyances. Surely it should be an easy question to solve when such a small outlay of capital is involved, in comparison with the great traffic which constantly passes over the roads.

THE LANGUAGE OF HAWAII.

BY W. R. GERARD.

Polynesia, which comprises a number of distinct archipelagoes, upon which are dependent several smaller groups, is inhabited by a brown-skinned people, with dark or black, smooth, curly hair, who are shown by their mythology, traditions, customs, and language to belong to one and the same race, to which ethnologists and philologists of recent years have applied the distinctive name of Mahori. A line drawn from New Zealand through Samoa northeast to Hawaii, all inclusive, very nearly defines their western limits. They are in exclusive possession of the whole of the water area to the right of this line as far as to Easter Island, and left of it are nowhere now found in an unmixed state, except in the Ellice and Union groups, and at a few scattered points in the New Hebrides, and in the southeast and perhaps northeast coast of New Guinea. They are thus shut off by the intervening Papuans from the Indian Archipelago, of which, in ancient times, they appear to have been the autocthones, and whence they emigrated eastward at a very early period and arrived first at Savaii, the largest island of the Samoan Archipelago. Their further migrations from archipelago to archipelago can be traced with some certainty through the uniform traditions of the various groups. In these traditions Savaii is constantly referred to under names that, in form, well illustrate the permutation of letters in the closely connected Mahori languages: Savaiki, the original Mahori form of the word; Savaii, the Samoan form; Havaii, the Tahitian; Hawaiki, the Maori; Havaiki, the Marquesan; and Hawaii, the Sandwich form, which became the name of the chief island of that group. It is not implied that each people came directly from Savaiki, but only that the several migrations took place at times when the name of its primeval home was still fresh in the memory of all, or at least survived in some mythological form.

The language of the Mahoris belongs to a primitive unmixed form of speech but one degree removed from the isolating or lowest stage (typified in Chinese), and occupying a sort of intermediate position between it and the true agglutinating tongues typified by the Finno-Tartaric family.

The peculiarities of this great linguistic family are a limited phonetic system; a great predominance of vowels over consonants; almost total absence of inflection; wonderful homogeneity; imperfect differentiation of the various parts of speech; and the curious practice of "tabooing" words, such as those forming parts of a chief's name, either during his lifetime or after his death.

The Hawaiian language of the Sandwich Islands (which were originally peopled from Tahiti, soon after its settlement by the Samoans) has become much changed and enfeebled in its phonetics. Manley Hopkins, former Hawaiian consul-general, says of it that it "is so soft as rather to be compared to the warbling of birds than to the speech of suffering mortals."

Every syllable, and consequently every word, ends in a vowel, and no two consonants can come together without the interposition of a vowel. No Hawaiian can pronounce correctly a word that ends in a consonant; his voice slides irresistibly into a vowel sound. Thus, in pronouncing Boston or London, he will say Bosetona and Lonedona. Hence, as syllables often begin and always end with a vowel, it is obvious that there must be a perpetual concurrence of sounds which renders the pronunciation of words difficult to acquire, although each sound is extremely simple in itself. The ratio of vowel to consonant sounds is nearly twice as great as in Italian.

In reducing the language to writing, the American missionaries employed 12 letters, viz.: 5 vowels, a, e, i, o, and u, having the invariable sound that they possess in Spanish; and 7 consonants, h, k, l, m, n, p, and w. These suffice to represent all the sounds in the language; but, in order to give proper expression to names of persons, places and things of other countries with which the Hawaiians need to become acquainted, and especially to Scripture names, the following nine consonants were added to the alphabet: b, d, f, g, r, s, t, v, and z. In the pronunciation of words, the full accent usually falls upon the penult, and there is a secondary accent upon the syllable preceding the antepenult.

As in all other languages of the same family, there is a deficiency in general terms and in words to express abstract ideas. At the same time, the language abounds in nice distinctions and possesses a copious vocabulary. It has no verb substantive nor any verbs to express existence, possession or duty. There are no variations in nouns for case, number, or person; but the moods and tenses of verbs are pretty clearly distinguished by simple prefixes and suffixes.

Upon the whole, says Sir George Simpson, the Hawaiian language may be considered as pleasing and agreeable to the ear after a time, although at first it sounds childish, indistinct, and insipid. It lacks anything like force and expression; and the natives are by no means to be compared, as orators, to the aborigines of North America. The language is not capable of reaching the lofty strains of the Blackfeet, Crees and other Indians, but flows in a mellifluous feebleness which, though it never offends the ear, always leaves us unsatisfied. The indistinctness and confusion which arise from the scantiness of its elements, and its consequent repetition of the same sounds, are considerably aggravated by the copiousness of the vocabulary, which is said to be in a great measure due to the pride and policy of the chiefs, who habitually invented new words for their own peculiar use, and constantly replaced them, as soon as they became familiar to the people, with other novelties of the same kind. Under such circumstances, to say nothing of the intricacy and precision of the grammar, a foreigner can never hope entirely to master the tongue; and missionaries, even, despite industry and zeal, often find their ears at fault, more particularly when the natives chant their barely articulate strings of words in a quick and monotonous strain.

The Hawaiians, moreover (says the same writer), have a different dialect for their poetry; or, at least, if the language be the same, its inflections and construction appear to be very different, and its metaphors and allusions, which give enjoyment to the native race, elude the comprehension of residents who are well acquainted with the Hawaiian language used in prose.

A young poetess, now dead, who bore the name of Poki, enchained the people with her lyrics; yet a gentleman who knew Hawaiian prose so perfectly that he could report in shorthand the speeches made in the house of legislature was entirely baffled in his efforts to comprehend the poetry that by turns melted and inflamed its native hearers. This is probably explainable by a fact mentioned by Mr. Hiram Bingham, namely, that Hawaiian poetry is not accurately measured, either in respect to the succession of feet or the length of the lines; nor did it, prior to the introduction of hymns by the missionaries, exhibit any rhyming at the end of the lines. As the songs were unwritten and adapted to chanting rather than to metrical music, a line was measured by the breath; the "hopuna," answering to our line, was as many words as could be easily cantilated at one breath.

The people are fond of fabulous tales and songs, and formerly spent much of their time in telling stories and crooning meles (songs) to the accompaniment of a small drum or musical stick.

The missionaries found great difficulty in translating the Scriptures into Hawaiian by reason of the number of words therein for which the language has no equivalent and of which the natives have no conception: such as faith, virtue, chastity, holiness, angel, throne, etc. The native conception of an angel is either kanáka léle, a "flying man," or akúa, a word corresponding somewhat to the Algonkin term manito —a spirit, something to be worshiped, or anything of a mysterious nature.

In giving names to each other and to their children the Hawaiians have always exhibited considerable whimsicality. The most trifling circumstance fixes their nomenclature, and names are as likely to be taken from things and qualities disgusting and vile as from those of the opposite character, and are borne without shame or disgrace. Thus, there are persons named Moékolóhe, "Adultery;" Kekúko, "Lust;" Kakáhu, "Anger;" Haahéo, "Pride;" Aihúe, "Thief;" Waháhe, "Liar;" Pelapéla, "Filth;" Inuráma, "Rum-drinker," etc. It is also customary for persons to exchange names with each other or to assume new ones at will. The origin of some of such names is amusing. Thus, when Kapíoláni, the woman chief at Kealákekúa, was sick and had to submit to a surgical operation, a child of one of the commonalty that happened to be born at the time was called by its parents by a name signifying "Four-inches-long," in order to commemorate the length of the incision made by the surgeon's knife.

Some of the names given to or assumed by members of the royal family remind us of those borne by some of the North American Indians. Thus the name of the king who reigned at Hawaii at the time of Capt. Cook's arrival in 1778 was Kalaníopúu, or "Budding Heaven." His nephew and successor was Kaméhaméha, whose name, subsequently assumed by four other kings of the dynasty, means "The Lonely One," or "The Solitary One." The favorite wife of this monarch was Kaáhumánu, or "The Feather Mantle," while the favorite of his successor was Kamamálu, "The Umbrella." Before Kaméhameha III. assumed the dynastic name he was plain Kauikéaoúli, or "Hanging-on-the-dark-sky."

The quick, observing eyes of the Kanakas or natives saw much to amuse and astonish them in the attire of the missionaries and their wives, whom they for a long time called Aióeóe, or "Long necks," because of the additional length of neck that seemed to be given to the ladies by the poke bonnets that they wore, and which were humorously designated as "hats with spouts."

The Hawaiians have a custom, similar to that which prevailed among the Hebrews, of occasionally conferring upon a person a new and significant name commemorative of some remarkable event in which he or she has been concerned. Thus Kaméhaméha IV., upon the death, in 1862, of his first and only child, bestowed upon his consort the name of Kaleleókaláni, an appellation by which she is now generally known, and by which she frequently subscribes herself. To make the sentiment and appropriateness of this new name understood, it is necessary to explain that nearly all the names of the superior chiefs end in lani, which has the double meaning of "chief" and "heaven," its radical idea being that of height or elevation. The name Kaleleókaláni may consequently be interpreted either as the "flight of the chief" or the "disappearance of heaven;" so that each version expressed in sympathetic and poetic language the loss sustained by the mother who received and the father who inscribed this epithet of the heart.

Upon the death of Kaméhaméha in 1863 the name of the queen was changed once more, but this time by the people in affectionate sympathy. The adjective particle na, meaning "all" or "entire," was substituted for ka, which is genitive singular. So that the desolation of the wife as well as of the mother, instead of being denoted by Kaleleó-ka-láni, "the flight of *the* chief," or "of *the* heaven," was thenceforward expressed by Kaleleó-na-láni, "the flight of *all* the chiefs," or "of *entire* heaven;" for it seemed to the people that to their queen all joy was now darkened and that earth to her was utterly void.

CAMILLE A. FAURE.

We regret to note the death of Camille A. Faure, the French electrical engineer, who died on September 14. He is chiefly known by his improvement of the storage battery. He was the first to build up the negative "pasted" plates with prepared spongy lead in place of the electro-chemical deposition process of Planté. He was born in 1840 and was largely self-taught. In 1878 he first appeared in the storage battery field, and in 1882 he made other important improvements by adopting methods of increasing the surface of plates with a given volume, and later by surrounding the plates with a porous covering. Faure also introduced improvements in the manufacture of explosives and in electro-chemical work.

THE MAMMOTH CENTRAL POWER STATION OF THE METROPOLITAN STREET RAILWAY COMPANY, NEW YORK.

We have from time to time referred to the remarkable system of street railways owned by the Metropolitan Street Railway Company, New York. In our issue of October 22 will be found an account of the extensive changes which are being made by the company in the way of substituting mechanical for horse traction on the 228½ miles of road included in the system. When the reconstruction which is immediately in hand has been completed, there will be a total of 90 miles of road worked by mechanical traction. In this will be included the cable roads on Broadway and Lexington Avenue, the underground trolley systems on Second, Fourth, Sixth, and Eighth Avenues, and on Fifty-ninth and Canal Streets, together with the use of compressed air motors on a few of the other crosstown lines. These are the changes at present under way; but it is intended, ultimately, to abolish the horse car altogether, and operate the whole system of railways electrically, except some of the cross-town lines, which will be served by compressed air motors if the latter continue to give satisfaction.

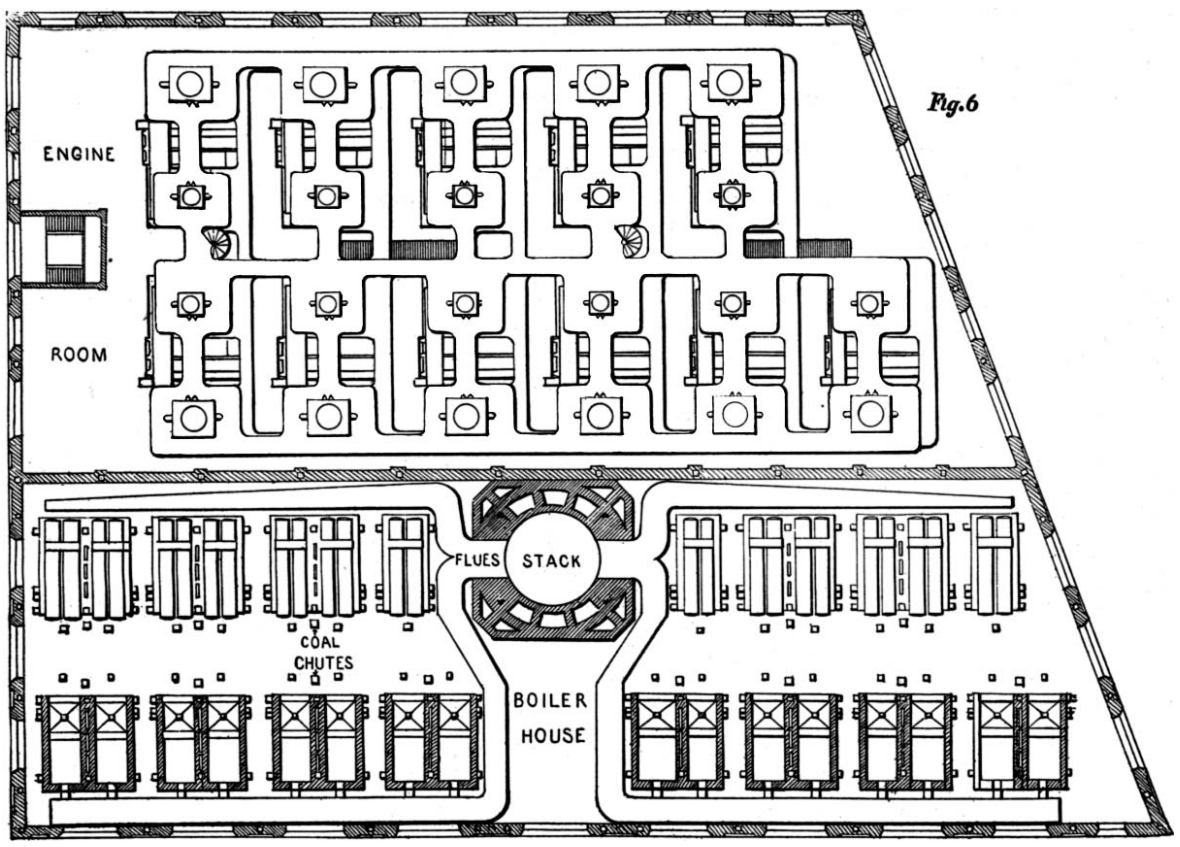


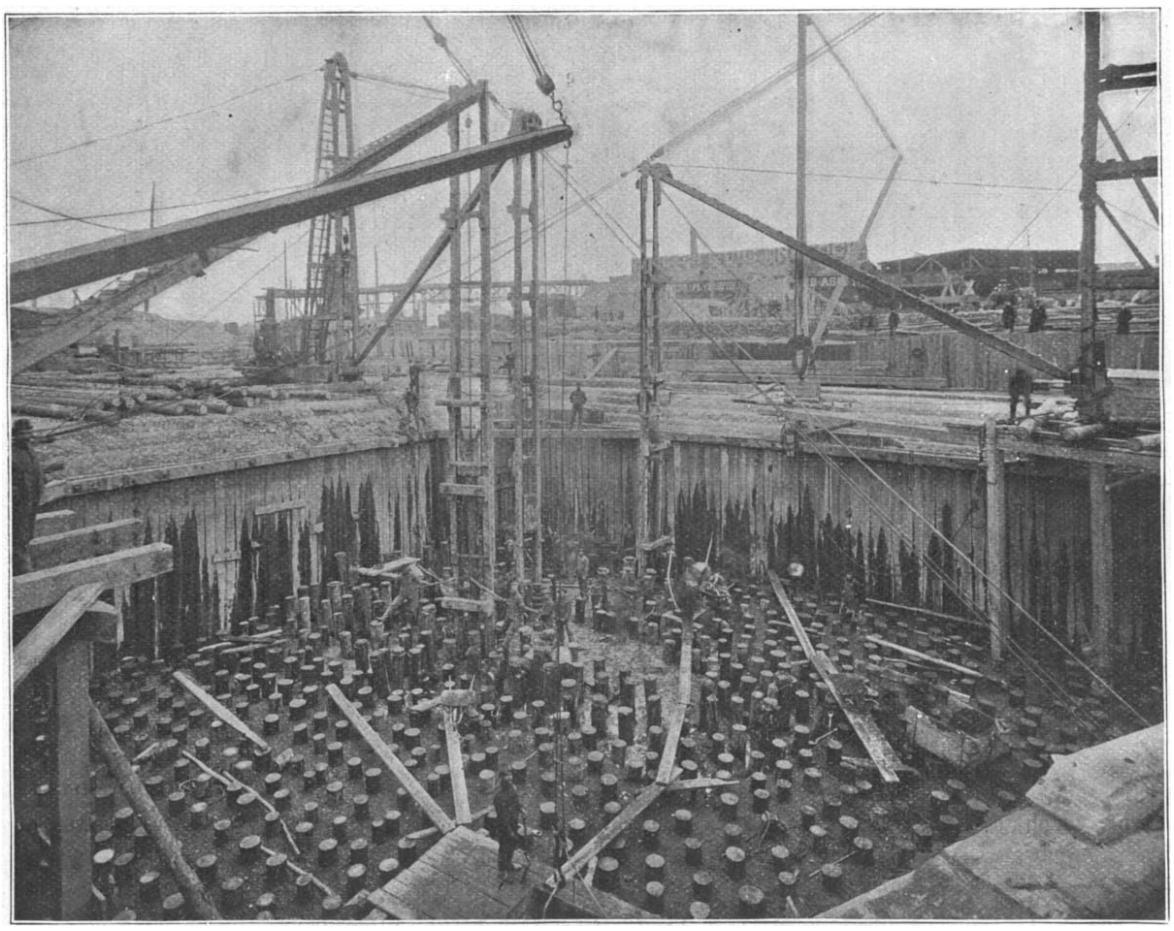
Fig. 6

6.—PLAN OF THE 70,000 H. P. POWER STATION OF THE METROPOLITAN STREET RAILWAY COMPANY, NEW YORK.

At present the problem of supplying the increased demand has been met by increasing the capacity of the power stations at One Hundred and Forty-sixth Street and East Twenty-sixth Street; but, with a view to meeting the demand when practically all the lines shall have been electrically equipped, the company determined to erect one great central power station of sufficient capacity to supply the whole system.

The new buildings and plant, as might well be expected, are on a vast scale, the total capacity of 70,000 horse power being far in advance of any other aggregation of steam power in the world. The next largest power station in this country is that of the Brooklyn Heights Railroad, near the Navy Yard, Brooklyn, which has a maximum capacity of 15,000 horse power, and, as far as we know, this is at present the largest in the world. It is a curious fact, too little appreciated, that by far the most powerful aggregations are to be found in the engine rooms of the ocean liners, the "Campania" and "Lucania" having each indicated 33,000 horse power on their trial trips.

The site of the new power house is a block of ground lying, as shown in Fig. 2, upon the East River, between Ninety-fifth and Ninety-sixth Streets. In view of the enormous loads that had to be carried, and the fact that the material of the site consisted of made ground, mud, sand, and underlying gravel, it was decided to drive piling over the whole site with a view to securing an absolutely firm foundation. Accordingly, no less than 7,854 piles were driven, with an average penetration of 35 feet. They were then cut off to a uniform level and the soil was cleared away, leaving the heads of the piles exposed. Concrete was laid and carefully tamped around and over the piles and carried up to a level four feet above the point of cut-off. The finished site now presented a uniform concrete floor for the reception of the engine and boiler foundations.



7.—DRIVING THE 1,300 PILES FOR THE FOUNDATION OF THE 353-FOOT STACK. THESE WERE COVERED WITH A MASS OF CONCRETE 20 FEET IN THICKNESS.

The most striking object at the power house is the great smoke stack, which occupies a mid position between the engine and boiler rooms. It takes rank as one of the largest structures of its kind in existence. Though it is not so lofty as the great stack at the chemical works in Glasgow, which is about 450 feet in height, it is much more massive. The principal dimensions are as follows: Height, 353 feet; base, 55 feet square; outside diameter 80 feet above the ground, where the circular shaft commences, 38 feet 10 inches; diameter at the base of the neck, 26 feet 10 inches; the uniform internal diameter is 22 feet. The neck is 47 feet high and flares outwardly to a diameter of 35 feet. The stack consists of two distinct concentric shells, the inner shell being separated from the outer to allow the former to expand and lengthen under the action of the hot gases. The inner wall varies in thickness from 24 inches at the base to 8 inches at the top. It extends only to a height of 340 feet. The outer wall varies from 28 inches to 20 inches in thickness and extends the full height of 353 feet. It is stiffened by 12 vertical inwardly projecting ribs which extend radially toward the inner shell, but do not touch it. The ribs are 24 inches thick at the base and taper to 8 inches in thickness at the top. It will be seen that this construction gives great stiffness for a minimum amount of material. The inner flue is lined with 9 inches of firebrick up to the 85-foot level, above which the lining is 4½ inches in thickness up to the 115-foot level. Outside staging was used in erecting the stack up to the 125-foot level, and from there up it was entirely erected from the inside, as shown in Fig. 1, on the front page. The batter of the stack is at the rate of $\frac{5}{16}$ of an inch to the foot from the 80-foot to the 306-foot level, at which the neck commences. There are three large flue openings, one above the other, on the east and west sides of the stack, one at the level of each boiler floor.

There are 3,400,000 bricks in the stack and its weight is 8,540 tons. This weight is carried on 1,300 40 foot piles, which were driven to an average depth of 37 feet, and capped with a mass of concrete nearly 60 feet square and 20 feet in thickness.

By reference to the plan view and section, it is seen that the building, covering the entire block, which measures 201 by 270 feet, is divided by an east and west wall into two halves, the southern half being the boiler house and the northern the engine house, the former of which incloses the base of the great stack. The boilers, of which there will be 87 in all, will be arranged in two parallel lines on each of the three floors of the boiler house. They will be grouped in batteries of two each, and the maximum capacity of each boiler will be 800 horse power, making a total for the 87 of about 70,000 horse power. Above the boilers will be a coal storage bin, extending the full length of the house, having a capacity of 9,000 tons. The coal will be transported from the vessels at the dock to the bin by mechanical conveyors, and fed to the fronts of the boilers on each floor by chutes—handling being thus reduced to a minimum, and all the costly trucking which is necessary in power stations in the heart of the city being avoided.

Our illustration, Fig. 5, shows the work of erecting the boilers in progress. The gases will pass from the boilers into large horizontal flues which extend at the back of each line of boilers and are led round to converge at the flue entrance to the stack on each floor, as shown in the plan view, Fig. 6. One of the horizontal flues is seen in Fig. 5.

The engine room will contain the most magnificent group of engines and dynamos ever gathered in a single engine room. Set up in two long rows, the longer of which will extend for 200 and the shorter for 175 feet, will be eleven great cross-compound engines, each of 6,600 indicated horse power. The two high-pressure cylinders will be 46 inches and the two low-pressure 86 inches in diameter, the common stroke being 60 inches.

Each engine will drive, by direct connection, a 3-phase, alternating current generator, the armatures being placed on the main shaft in the center of the engine. The generators will operate at 6,000 volts and the current will be led to eight substations, conveniently situated with reference to the various lines, where static and rotary transformers will convert the current to a pressure of 550 volts, at which it will pass to the conductors. The illustration (Fig. 4) shows the massive character of the foundations for the engines and generators. Each of these piers measures 28 feet by 43 feet on the base and rises to a height of 29 feet above the concrete foundation. It took 450,000 bricks for each pier,

or 4,950,000 bricks for the eleven engines. This added to the number of bricks used in the stack makes a total of 8,300,000 bricks for the foundations and stack alone.

Flags of Our Warships.

In the Equipment building at the New York navy yard there is a large manufactory where most of the flags of our navy are made. A large vessel carries forty American flags, and a smaller vessel almost as many. This does not include the fleet and international signal flags and the flags of other countries. There are three rooms in the Equipment building which are given up to flag-making. One of these is very large and the others on either end are much smaller. There are sewing machines, scissors, pincushions, and flat-irons scattered around, so that the place does not look unlike a patriotic dressmaker's establishment. The flags are all made by women, though a few men help to cut out the stars and do the finishing. The wind and weather destroy flags so fast, and new vessels are put into commission so rapidly, that it is necessary to employ a number of people even in time of peace. The working hours, during the present war, were extended from eight o'clock in the morning to five o'clock in the evening to eight o'clock in the morning to ten o'clock in the evening. In one week eighteen hundred flags were made at the flag department, and this was when the rush of work was about over. The women cut all the square flags and the devices for them. The men cut the stars and bias pennants and put on the finishing touches and the heading through which the rope runs. They also put in the rope and stencil the flag with the size and nationality. There is a pattern for every flag, and the patterns are put away in paper bags when not in use. There are forty-four flags in a set of general signals used in the navy. These are in three sizes, while the regular flag is made in nine sizes. The largest flag measures 36 feet long, while the smallest is only 30 inches. Pennants are made up to 70 feet long. There are nineteen international signal flags and forty-three foreign flags which are made at the navy yard. There are no specialists in the workroom, and the women make any flag which may be assigned them. Of course it is necessary to have the flag exactly the same on both sides, which makes the work very difficult, especially with foreign flags, where the devices are in much detail. It may be truly said that some of the flags are fancy work on a Gargantuan scale. Here are wonderful landscapes, with round-faced suns with halos coming up from behind gay colored mountains over which run rainbows in four or five lines of outline or chain stitching, making a scene which would surprise an artist. Water must be indicated with some kind of embroidery stitch. Whole menageries of animals have to be represented on some flags. Flags of Costa Rica and San Salvador are considered the most difficult to make, says The New York Times, from which we glean our facts. The German flag is also considered difficult. The largest foreign flag is only 25 feet long. The largest sized American flags are made of 19 inch bunting and the narrow pennants are made of 4½ inch bunting, which comes on purpose for them. Each flag which is made is measured on the floor over the seams and sewed to insure the exact measurement. There are metal pieces let into the floor and each one is marked for the different flags. It is an inspiring sight to see the manufacturing of these flags, and it seems curiously appropriate that women should be selected to make them. Preparing the colors for gallant warriors who go to fight seems to have always been an essentially feminine duty which has obtained from very early days. In the middle ages fair ladies embroidered the banners under which their knights fought, and although flag-making is now put on a business basis, it has been the work of the women in the United States since the first flag of the country was made down to the present day.

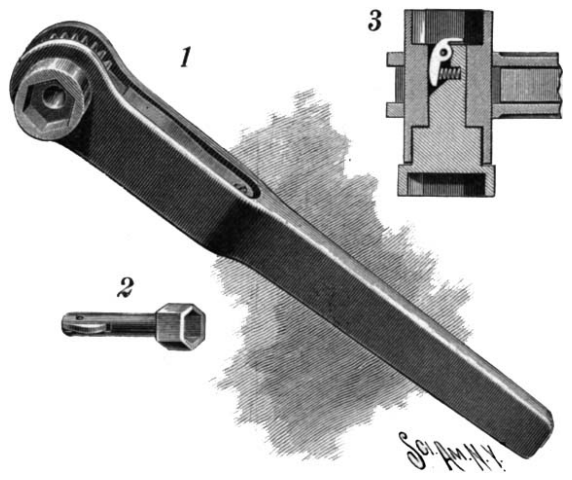
AN ATTACHMENT FOR SOCKET-WRENCHES.

In order to enable a socket-wrench to engage nuts of different diameters, a device has recently been invented which, when applied to a wrench, permits a wider use of that wrench than would otherwise be possible.

Of the annexed illustrations, Fig. 1 represents a ratchet-wrench in perspective; Fig. 2 the removable device or socket piece; and Fig. 3 an enlarged section of the socket-end of the wrench, showing the socket-piece applied.

The ratchet-wrench illustrated is provided at one end with a rotatable barrel having sockets in each end formed to engage nuts of a certain size. These two sockets are connected by a central aperture, circular in cross-section. The auxiliary socket-piece has a stem or shank, which, when the socket-piece is in use, is inserted in the central aperture of the wrench-barrel, as indicated in Fig. 3. On the stem a head is formed which coincides in shape with the socket of the wrench-barrel. The head of the socket-piece is provided with an auxiliary socket, the diameter of which may be smaller or larger than that of the wrench-socket. In Fig. 3 the auxiliary socket is shown projecting from the wrench-barrel to engage nuts of a diameter larger than that of the wrench-socket.

In order that the socket-piece may not be displaced from its position, a spring-pressed friction-block is pivoted in a slot formed in the end of the stem of the socket-piece. The block being pressed against the barrel of the wrench, holds the socket-piece with a



HAGGERTY'S ATTACHMENT FOR SOCKET-WRENCHES.

force sufficient to prevent its dropping out, in whatever position the wrench may be placed.

The attachment forms the subject of a patent controlled by J. Henry Haggerty, of 50 South Street, New York city.

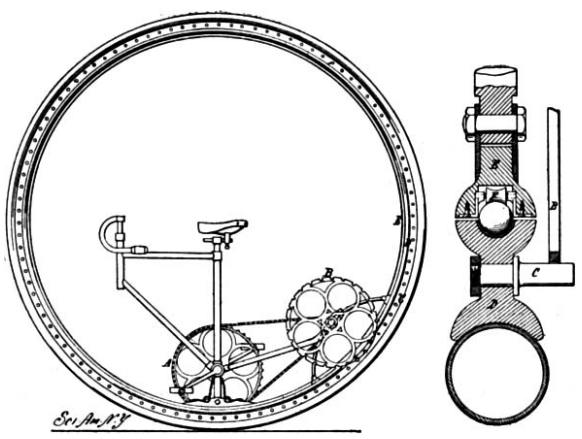
A UNICYCLE OF NOVEL FORM.

In the accompanying engraving we have illustrated a unicycle which, by reason of its novel construction, has attracted not a little attention.

The main feature of this unicycle is found in the formation of the spokeless wheel, the rim of which is made in two sections, turning upon each other. The driving gear is secured to the inner section of the rim.

As shown in our side elevation and section, this rim is composed of the two parts, *D* and *E*. The part, *D*, has a concave portion which receives the tire of the wheel and which is connected by a web with another portion semicircular in form, constituting a ball raceway. Between this raceway and the recessed portion of the part, *E*, balls are placed which are engaged by rollers, *F*, adapted to take up the wear. Thus constructed, one portion of the rim will turn upon the other, the friction being reduced by means of the balls and rollers.

Of the two parts of the wheel rim, *E* is the stationary section and *D* the traveling section. The web of the traveling section, *D*, is provided with pins, *C*, extending horizontally from one side.



SIDE ELEVATION AND SECTION.

THE UNICYCLE IN OPERATION.

By means of the pedals, the rider drives the sprocket-wheel, *A*, the motion thus produced being transmitted by means of a chain and small sprocket-wheel to the drive wheel, *B*, slotted to engage the pins, *C*, of the traveling section, *D*.

The drive wheel, *B*, and the small sprocket-wheel are mounted on a single shaft moving in a slot concentric with the wheel rim. The shaft is connected with the seat mast by links, the forward ends of which receive the ends of the pedal shaft. By throwing his body toward the front, and thus bringing his center of gravity forward, the rider, it is claimed, is relieved of much of the work necessary to drive the wheel. The movement of the saddle naturally produces a corresponding movement of the drive wheel shaft in its slot. The inventor states that the wheel may be steered by inclining the body to the right or to the left.

The unicycle has been patented by Vernon D. Venable, of Farmville, Va., and has been in actual use for two months.

The Measurement of Sunshine at Health Resorts.

Jones (Lancet) has been measuring the actinic value of the sunshine, in summer and winter, in London and at Llangammarch Wells, a mountain resort in Wales, where the air is particularly pure and clear. He found that the actinic value of the sunshine in the latter place was in an hour of a summer's day from three to five times that of London under similar conditions of clear or clouded skies. In the winter the difference was not so marked, but the Wales sunlight was about twice as strong as that of London. A comparison with the results of similar tests made in the high Alps shows that the air may be just as pure in a mountainous district or far less lofty elevation. These tests are essentially a test of the purity of the air, as the amount of heat in the sun's rays has no effect upon the result. The method employed is briefly as follows:

A solution of potassium iodide is prepared containing 20 grammes to the liter of water; also, a solution of pure sulphuric acid, 11·6 grammes to the liter of water; and a third solution in which a liter of water contains 0·39 gramme of powdered arsenious acid and 1·5 grammes of potassium bicarbonate. To make a test of the sunlight, 10 cubic centimeters of solution No. 1 and an equal amount of No. 2 are placed together in a glass stoppered bottle on a white porcelain plate, and exposed to the action of the sunlight. At the end of an hour the bottle is removed and enough sodium bicarbonate is added to it to just neutralize the acid. The bottle is then placed under a burette containing the solution of arsenious acid, and the latter is run in until the color of the iodine is completely discharged. The results are expressed in milligrammes of iodine liberated per 1,000 cubic centimeters of solution used. Since in practice 200 cubic centimeters of the mixed solution are used, the results obtained were multiplied by five to bring them up to the accepted standard.

Sunlight has a well known inhibitory effect upon the life of pathogenic organisms. Direct sunlight will kill tubercle bacilli in a few hours or perhaps in a few minutes; whereas they will live for days if exposed to a very strong diffused daylight. The exhilarating effect of a burst of sunshine in the spring is probably not due to mere luminosity, but to an increased actinic action, a chemical action which we cannot very well explain, but which every one feels. In estimating, therefore, the value of a health resort, the amount of this actinic value in the sunshine ought to be taken into account, no less than the number of days upon which the sun shines during the month or the year.

The Mitis Patent Sustained.

The United States Circuit Court of Appeals on October 21 affirmed the decision of Judge Acheson in the United States Circuit Court at Pittsburg, sustaining the Mitis patent for the use of aluminum in the manufacture of steel ingots and castings. The litigation has lasted nearly four years, suit having been brought by the United States Mitis Company against the Carnegie Steel Company, to restrain the latter from alleged infringement of patent. The Carnegie Company appealed on decision of the lower court and was enjoined from using the patent, and now that the Court of Appeals has upheld that finding, it is said that the Carnegie Company has taken out a license under the patent and made settlement for the past infringement.

Oscillation of the Eiffel Tower.

According to a report to the Academy of Sciences in Paris, by Colonel Bassot, the Eiffel Tower is subject to variations of inclination. He thinks that this is only due to the contraction and expansion of the enormous mass of iron caused by the changes of temperature. From sunrise to night the difference to and fro amounts to 20 centimeters, but the stability and strength of the iron structure are not influenced thereby.

Miscellaneous Notes and Receipts.

Gold Solder or Gold Alloys for dentists' purposes are obtained by fusing together 53 parts (by weight) of refined copper with 25 parts (by weight) of pure silver and 12 parts of tin. According to the admixture of gold, every carat is obtained. If very high carat gold is wanted, the tin is left out and the quantity of copper is correspondingly reduced.—Technische Berichte.

Osmium threads which are to take the place of the platinum wire, and give an exceedingly bright light when the electric current passes through them, have been patented by Auer von Welsbach. The manufacture of these incandescent light tubes consists in covering a thin copper wire with osmium metal and annealing the wire at the highest temperatures. The copper evaporates, while the coating of osmium remains unchanged in the shape of a hollow thread.—Neueste Erfindungen und Erfahrungen.

Italian Earth Colors.—Chief emporium and mart for all Italian colored earths is Leghorn, where a special branch of industry has developed for working them. The principal firm of the branch there is that of Enrico Ganni & Company, the chief products being sienna (Terra di Siena), ocher, and umber. All these different varieties of earth are mostly found in the vicinity of Monte Amiata, Province of Grosseto, while the Province of Siena only has very insignificant beds of them, and none at all are found in the environs of the city of the same name. Why the term of "Terra di Siena" (earth of Siena) was adopted therefore seems inexplicable. Yellow ocher is almost exclusively found on the surface of the earth, while sienna earth is met with in deeper strata, the inferior qualities lying higher, the better ones deeper. Thus the upper stratum furnishes "bolo di terza," third quality; the mean one, "bolo di secunda," second grade; and the lowest, "bolo di prima," first quality. From the latter another grade of the very best quality is sorted out by hand, which is called "spurgo di bolo" or "giallone" in Italy and is known in Germany under the name of "electa." The earth raised from the depth generally contains 70 to 80 per cent of water, and, therefore, is first cursorily dried by air and sun. Raising is, as a rule, only done in summer, because during the rest of the time the damp weather renders the work very difficult. Burning, however, is performed at almost any time, at the place of production, charcoal being employed, unless it be preferred to send the material in a raw state to Leghorn and to treat it there. But, as a general rule, only the breaking up and grinding of the products of the country are done at Leghorn. Thus it is that the color earths get there in four different forms, viz.: 1, Entirely raw; 2, burnt and unground; 3, unburnt and ground; and 4, burnt and ground.

The working in Leghorn is simple enough. The raw earth, which has only been superficially dried at the place of production and still contains 20 to 25 per cent of moisture, is dried before the breaking up, in moderately heated furnaces, whereby the percentage of water is reduced to about 5. Then it is burnt in stone furnaces at an exceedingly high temperature and only superficially broken up on the first mill, finally grinding it into fine dust between granite stones in huge steam mills.

Turkish umber, from Cyprus, is also sent in sailing vessels to Leghorn, and is stored in vaults which date back to the time when the city possessed the principal harbor of the Mediterranean Sea. Of this Turkish umber, three special varieties are distinguished. "Lisamol," very light; "Larcana," darker; and a very dark one, virtually black. The material is always brought on in a raw condition, and carefully assorted before the working. Same is dutiable upon importation into Italy at 4 lire per centner, but a drawback is paid when the finished merchandise is re-exported. The burning of the umber is not essentially different from that of sienna and of ocher. The material is shaped into lumps of the size of melons and placed on iron gratings in the furnaces. By this method the color is said to be improved. Frequently, however, it is burned just the same as the other kinds. In 1897, 721,000 kilos of Turkish umber earth were imported into Leghorn, of which 550,000 kilos were again sent abroad after being worked up. From Sardinia, Leghorn receives light and dark ocher in a raw condition, but it is far inferior as regards quality to that of Tuscany.

The price of the different products on the spot varies greatly according to the shades and qualities. In 1897 the price for unburnt sienna fluctuated between 80 and 240 marks ($19–$57) per ton, according to quality; that for raw unwashed ocher ranged from 70 to 110 marks ($16–$29); for the washed product from 160 to 200 marks ($38–$48); while umber earth was sold at 40 marks ($9.50) per ton. The three varieties of sienna known in Italy under the denominations of "chicco," "gripolo," and "polvere" cost 80 to 400 marks ($19–$96); "Spurgo di Bolo," burnt, 1,200 marks ($288); the first three varieties powdered, 120 to 600 marks ($28.50–$144); the latter up to 1,400 marks ($336) a ton; umber burnt, 60 marks ($14); powdered, 110 marks ($26).—Translated from the Färben Zeitung.

Filtration and the Water Supply of Cities and Towns.

Filtration, as a means of securing the desired purity in the water, is strongly advocated in some cities where the improvement of the supply is being made the subject of investigation, and the subject is just now one of increasing interest and very vital importance.

The value of the filter for domestic use is not to be denied. They have the advantage, because of their portable character and moderate dimensions, of being readily cleansed or renewed; but if they are neglected, they may become a source of the very danger that is sought to be avoided.

A city filtration plant is a more difficult problem. It is expensive to install, requires an immense area, demands constant inspection and a frequent renewal of material, all of which will add materially to the annual municipal burdens.

Whether the best known methods of filtration, as applied to large water plants, afford the desired protection, especially as regards the dissemination of disease, appears to be open to some doubt.

From time to time, during the last two decades, the filtration and purification of water have been made the subjects of special investigation by the Franklands and by the British government through the medium of the laboratories of the Army Medical School at Netley, some of the investigations being undertaken on behalf of companies supplying East London with water. These and other investigations on a smaller scale have supplied us with sufficient data to permit reliable deductions to be made.

Ordinary filtering plants, as applied to municipal supply, consist of an upper stratum of sand superimposed upon a layer of gravel of gradually increasing coarseness; these strata vary in thickness, from 14 to 28 inches of sand and 24 to 36 inches of gravel.

Common silicious sand that is not too fine—that presenting clean, sharp, angular particles is best—acts to a certain degree mechanically. As the water passes through, the impurities held in suspension, whether organic or inorganic, adhere to the angles and plane surfaces of the grains. The result is highly satisfactory as far as it goes; but the action upon organic matters is very imperfect. Further, as the sand becomes incrusted with inorganic material, it rapidly loses its effect upon the organic, and thus ceases to act as a filter. On the contrary, if not frequently renewed, it may, after a considerable period, become an actual source of danger, by further impregnating water with material removed by previous filtrations.

Green ferruginous sand is more effective. It will, for a time, arrest all, or nearly all, organisms; but after being in constant use for a fortnight, in contact with water of the average character afforded by running streams, its value is considerably reduced. Safety, then, would demand that such filtering material be replaced with new, at certain stated intervals. Nearly as good, but not quite, is fine, well washed white sand that has been roasted to redness; and its virtues may be renewed by subsequent treatment at high temperatures.

The material obtained by roasting hematite ore, and which from time to time has obtained unstinted praise, is merely a porous metallic iron with manganese oxide. It occupies a space of about twenty cubic feet to the ton. As regards water, its action is both mechanical and chemical. Like sand, it arrests inorganic matters, and at the same time oxidizes organic material held suspended in solution; it even in a measure decomposes the water, setting free a portion of its oxygen to reinforce that evolved from the manganese. The experiments of the Franklands, and of Parke, prove that this material can be depended upon to remove the greater part of dissolved organic material, and, indeed, all such, if the exposure to its influence be sufficiently prolonged, and the resultant filtrate is bright, clear, and pure, and may, moreover, be stored for a long time without undergoing change. Its power is much more enduring than that of any other known substance or combination of substances; the great drawback being that, when once it is loaded with organic matters, it must be immediately renewed. Moreover, as hematite ore is very abundant in many districts of the United States, its cost for this purpose is fairly low.

"Magnetic carbide," so called, is prepared by roasting in a retort equal parts of red hematite and sawdust. Its value is not equal to that of any charcoal, and is decidedly inferior to hematite alone. "Manganous carbon," or "carbide," is another compound, of about equal value. It is claimed to be a mixture of animal charcoal and manganese oxide surrounding a block of "specially prepared carbon." "Carbolite" is of a similar nature, but is reputed to be even more expensive, without proportional increase of value. "Polarate" is another substance for which extravagant claims have been advanced. It is a magnetic, spongy carbon, consisting chiefly of iron oxide, along with some silica, alumina, and carbonates. It is understood to have given good satisfaction as regards house and small filters, but, like all other agents, requires to be renewed. It can readily be imagined that, like all filtration materials, by neglect it may defeat its end and become a positive source of impurity.

A compound that has obtained no little reputation in France among the non-expert—perhaps because it is a purely Gallic product—is made up of manganous carbon and lime permanganate. It purports to be not only equally effective as regards either mineral or organic substances, but also to completely sterilize any fluid brought in prolonged contact therewith. Manifestly this is a case of claiming too much, since there is no substance available for domestic or corporation purposes that is capable of removing all bacilli. Further, certain bacilli are essential to the purity of water that is to be stored and exposed, as in a corporation reservoir. Even the solid block of specially prepared porcelain, operated in connection with an air pump, as employed in physiological laboratories, is not invariably efficient. The theory advanced, however, becomes plausible, doubtless, when sounded in the ears of the laity; for it is declared that decomposition is induced by the manganese in the presence of organic matters, whereby they are "turned into oxygen," while the lime "consumes the micro-organisms." Even accepting the foregoing as possible, it at once is made obvious that the value of the material as a filter would be limited. Having once parted with its oxygen and become simple metallic manganese and lime, new sources of oxygen and renewal of chemical composition would speedily be demanded.

Animal charcoal, deprived of its calcium phosphate and carbonate by repeated washings or by treatment with hydrochloric acid, has long been deemed one of the best of filtering materials—and this is true as regards many fluids. Brought in intimate contact with water, it removes the suspended matters, organic and inorganic alike, the filtrate yielded being very clear and bright. But this substance also has its limitations. At first the organic matters are completely oxidized, but after a very brief period it becomes wholly inoperative.

In connection wth the experiments conducted at Netley, personally repeated and verified by Percy Frankland, it was discovered that while animal charcoal, for a considerable time, has a very rapid and powerful effect upon dead, decaying, or wholly decomposed organic matter, it speedily allowed fresh organic matter to pass through but very little, if at all, changed. Also that the filtrate requires to be utilized almost immediately, since it is prone to be speedily charged with new organisms. Again, its value is in a measure determined in proportion to the pre-existing purity of the water filtered, and to be at all efficient it requires to be replaced as often as every three months, and with very bad water, as frequently, perhaps, as every fortnight.

Vegetable charcoal, as had from the combustion of wood, peat, and seaweeds, is less efficient than the animal product; but reduced coke is in general more efficient than either, retains its essential filtration qualities longer, and for a time may be renewed by heating and the addition of a modicum of new material. It ranks second to hematite.

Railroad Signaling.

On the evening of October 31, in this city, Prof. George W. Blodgett, of Boston, and electrical engineer of the Boston and Albany Railroad, gave an interesting illustrated lecture, before the Academy of Science, on the past and present methods of railroad signaling. He illustrated the Hall method of automatic electric signals, which on some roads has been in use for over twenty years. It is a less expensive system than the separate cabin block method.

One of the most interesting improvements is the change from the mechanical interlocking lever and rod systems (which but a very few years ago was the most up-to-date) to the combined interlocking electric and compressed air (electro-pneumatic) system, which, he stated, was particularly well adapted to large yards. The latest yard equipped in this way is the new great Union station yard at Boston, which has nearly thirty tracks. The signal station building is large and is furnished with a series of horizontal switch bars operated separately by a handle on one end. At the rear of the bars, rising in a vertical plane, is a miniature model map of the entire system of tracks, showing the location of every switch and signal. Each switch is operated by compressed air stored in a reservoir adjoining the switch. The pressure is enough to work the switch five or six times in case the general supply, by accident, ceases. A boiler operates a compressor which keeps the air pressure uniform.

The electricity is furnished from storage batteries supplied by current from a general source. The operator first rotates the electrical switch bar to move the rail switch; as he does so, the switch on the miniature track before him moves, which assures him that the switch outside has also moved, then he rotates the signal electric switch, which causes the compressed air to set the large signal at a distance and allows the train to pass. All of these operations are done easily without difficulty and with a less number of men than by the old system.

Correspondence.

The Armament of the "Alabama" Class.

To the Editor of the SCIENTIFIC AMERICAN:

I am glad that the SCIENTIFIC AMERICAN has taken up the cudgels in favor of fitting our battleships of the "Alabama" class with the new 12-inch rifles of the navy. It seems to me that there can be no question of the wisdom of such a course. If the 13-inch rifles of the armament of these ships as originally planned are made, so much the better. We are in need of a reserve of heavy guns for an emergency, and if they were left unmounted until the new armament is ready, the objection could not be urged that the necessary delay of some months in furnishing the 12-inch guns would leave us unprepared for sudden war. I hope you will continue the agitation, for I believe there is no journal that has done so much to popularize the navy, and the friendliness of the organ to the navy makes its influence with the department very great.

WILLIAM H. HOBBS.

University of Wisconsin, Madison, Wis.

[We are satisfied that the sentiment expressed by Prof. Hobbs is representative of the feeling of the American people as a whole on this most vital question. We publish his letter as being characteristic of many expressions of opinion which have followed our advocacy of the new 12-inch gun as the main armament of the "Alabama" class.]

The Lightweight Bicycle.

To the Editor of the SCIENTIFIC AMERICAN:

I am a reader of your valuable paper, and have watched with much interest your criticism of the heavyweight bicycle of 1898.

If I may venture an opinion, I would say that I think you overlooked the cause somewhat in assuming that the heavier machines of to-day are the outgrowth of an attempt to suit the maximum-weight riders out of the regular stock of wheels.

I find from my limited experience that it is not the heavyweight rider who breaks wheels, but the boys and men whose weight will run from 75 pounds to 125 pounds. If I were to place my make of bicycle against another of equal grade for a season's test, I would select as the rider a man of 200 pounds in preference to a boy of 100 pounds.

A very small percentage of heavyweight riders are what we term "scorchers." They are generally men of an age that has caused their common sense to overcome foolishness, and are more careful in their riding for that reason and through fear of an accident and a fall.

The boy and the lightweight man are the riders we fear the most in the problem of construction. The rider that rushes along over rocky roads and over banks with a reckless don't-care-if-I-do-fall spirit is the rider who has called back the heavyweight bicycle.

I agree with you in your claim that the machine should be made to "conform to the weight of the rider," and will add, to the style of the rider, but am unable to see how the large factories are going to do this.

I am doing that very thing, and have been for several seasons, though my business is purely local, and I am always able to learn my customer's style, doing a custom business making wheels to order, as a tailor would a suit of clothes.

I think your diagonal strut for frame is the thing it needs, but believe it would be hard to make the rider accept it at once. E. C. SHUMARD.

Milford, O.

"Alabama" and "Canopus" Compared.

To the Editor of the SCIENTIFIC AMERICAN:

I have just read with pleasure your description of the "Wisconsin," United States battleship, as I take great interest in naval architecture, and in the article you make some comparisons between the British battleship "Canopus" and the United States battleship "Alabama," sister ship to the "Wisconsin." To quote from your article, you say that the "Alabama" possesses marked advantages over the "Canopus" in protection and weight of armor and in weight of batteries. I admit that the side armor is, of course, thicker on the "Alabama," but I do not think it is better distributed. The idea of prolonging the belt to the stem may be the best, and is after the French idea, but I think the only real way of testing the two methods would be actual warfare. Moreover, although the armor is thinner on the "Canopus" than on our "Magnificent" class, yet it is of equal resisting power, being of a much better quality, and the "Magnificent" class carries 2,880 tons of armor to the "Alabama's" 2,000 tons; and while the "Alabama's" protective deck is 4 inches to the "Canopus'" 3 inches, the "Canopus" carries an improvement in the shape of an armored main deck of 1 inch in thickness, independently of the curved deck. The main deck thus forms an armored floor for the upper deck 6-inch casemates. The upper deck also has plating to correspond and the other casemates are roofed and floored similarly. In addition to her other armor, the "Canopus" class carries 125 tons of nickel steel on the bows, to the thickness of 2 inches over the ordinary skin, and the ram and associated parts are a solid cellular mass, the material being at once stiff as well as elastic. Therefore, I think that although the "Alabama" may carry more weight of armor possibly, yet, on the whole, I cannot see where she possesses any advantage over the "Canopus," for distribution is as great a factor as weight.

Then, as regards the batteries of the two classes of ships, I think you'll find that in all probability the "Canopus" will carry the latest pattern of 12-inch and 6-inch guns, at all events, the 6-inch anyway; but even supposing they will not carry the latest patterns of these guns, the amount of energy exerted in a given time will be fully as much, if not more, in the "Canopus" than in the "Alabama."

The present 12-inch gun in use has a muzzle energy of 33,020 foot tons, with a muzzle penetration of 36·8 inches of wrought iron, and can be loaded and fired 9 times in 12 minutes. Your 13-inch gun has a muzzle energy of 33,627 foot tons, with a muzzle penetration of 33·5 inches wrought iron, and I don't think it can be handled in anything like as quick time, certainly not with the first breech mechanism that your guns were fitted with.

Then, again, take your 6-inch quick-firer, with a muzzle energy of 3,200 foot tons and a muzzle penetration of 15·4 inches wrought iron, as against the 7-ton pattern 6-inch gun in our service, with a muzzle energy of 3,356 foot tons, penetration 15·9 inches wrought iron and firing 7 rounds in 61 seconds; and if the newest pattern of 6-inch quick-firer is put on the "Canopus" class, it will be 7·4 tons in weight; muzzle energy of 5,373 foot tons; penetration at muzzle, 22·7 inches wrought iron, or 1·6 inches more penetration than your 40 caliber 8-inch breech-loader. Then, again, if I mistake not, the "Alabama's" light battery will consist of sixteen 6-pounders, four 1-pounders, one machine and two light guns. The "Canopus" will probably have ten 12-pounders, eight 3-pounders, eight machine and two light guns.

So that, although the "Alabama" will carry a greater number of guns, they are not as powerful. I don't mean to say anything in any way detrimental as regards the "Alabama," for I take it for granted that she is, or at least she and her sister ships will be most excellent fighting machines; but, looking at both types of vessels from the standpoint of an efficient battleship, i. e., taking into consideration the four great requirements, viz., speed, coal endurance, gun power, and defensive armor, I think, without a doubt, the "Canopus" the better ship of the two. As Lord Brassey puts it, "The weather gage of to-day is the power to outsteam the fleet of the enemy, the power to concentrate quickly, and bring on a general action at the most favorable moment. Speed is an all-important factor in fighting efficiency. It enables the gunner to choose his range far more than helm power, it endows a ship with handiness, and enables her to parry or avoid the blow of the ram. Speed is also a most important strategical factor."

In conclusion, I might say you can't put a quart of power in a pint of displacement. If a ship possesses any one quality in a larger percentage than a fair amount, one or more of the others then has to suffer.

Halifax, Nova Scotia. W. R. SHUTE.

The New Brooks Comet.

To the Editor of the SCIENTIFIC AMERICAN:

The new comet discovered by the writer on October 20 has been observed at the Smith Observatory on every clear night. While it was circumpolar, observations were made both in the evening and morning sky. From this date the comet will be in excellent position for early evening observations. The comet has been very generally observed from the great observatories, and Prof. Hursey, of the Lick Observatory, has computed the following elements and ephemeris, which has been communicated by the courtesy of the Harvard College Observatory:

ELEMENTS OF COMET BROOKS, 1898.

Perihelion passage	November 23. 1898
Perihelion minus node	= 123° 22′
Longitude of node	= 96° 10′
Inclination	= 140° 19′
Perihelion distance	0·7564

EPHEMERIS.

	Right Ascension.			
	h.	m.	s.	deg.	m.
October 27	16	35	48	+41	31
" 31	17	9	8	30	11
November 4	17	30	28	20	30
" 8	17	44	52	12	41
" 12	17	59	15	4	52

Although the former part of this ephemeris will have expired when this is in print, I have inserted it because it will, when plotted on a star map, indicate the path of the comet through the heavens. By extending it, the approximate place of the comet may be found beyond the latest date given above.

The comet is now in Hercules. It will pass through that constellation in a southeasterly course; pass just above the head and right shoulder of Serpentarius, and thence across the celestial equator. On November 6 it will form a great, nearly equilateral triangle with the bright stars Vega and Altair, below these stars.

The comet is increasing in brightness, and may be observed with telescopes of moderate aperture. It is a conspicuous object in the 10-inch refractor of this observatory, and was visible in the 3-inch finder in the presence of a half moon. WILLIAM R. BROOKS.

Smith Observatory, Geneva, N. Y., October 28, 1898.

Colonel Waring.

In our last issue we noted briefly the death of Colonel George E. Waring, Jr., which occurred in New York city, October 29. Colonel Waring arrived in New York from Havana on October 25. He had gone to Cuba, as a special commissioner of the United States, to find out the exact sanitary condition of Havana and to devise some plan of improving the condition of affairs. He contracted the very disease in Havana which he was trying to combat, and this resulted in his death on his return. Colonel Waring was born at Poundridge, New York, in 1833, and received his education at Poughkeepsie, where he studied engineering. He also took a course of agriculture and agricultural chemistry under the late Prof. James J. Mapes. He then undertook the management of Horace Greeley's farm at Chappaqua, where he remained for three years until in 1857, when he was appointed drainage engineer of Central Park, a position which he held until 1861. It was he who designed the present drainage system of Central Park and laid out the beautiful rows of elms on the Mall.

When the Civil War broke out, he went to the front as major of the Garibaldi Hussars. Later he raised a cavalry squadron with others, known as the Fremont Hussars. He was afterward transferred to the Department of the Southwest, where he received the title of Colonel. Colonel Waring obtained prominence as a sanitary engineer at the outbreak of the yellow fever in Memphis. In 1878 he changed the sewage system of that city by introducing methods of his which separated house drainage from surface drainage. This system has since been adopted by a great number of American cities, as well as some towns abroad. In 1882 Colonel Waring was appointed a member of the National Board of Health—a position which he held for a number of years, and in 1894 he became Assistant Engineer of New Orleans. As Street Cleaning Commissioner of New York city, he obtained a national reputation. During his administration the Department of Street Cleaning was thoroughly reformed and reached the highest possible degree of efficiency. For the first time during the present generation the streets were thoroughly cleaned, the employés were uniformed, their work was systematized, and some of the excellent means of disposing of the city's wastes which have been already described in the columns of the SCIENTIFIC AMERICAN were carried out under his direction. When it was decided to send a Government Commission to Cuba for the purpose of selecting camp sites in the island and making provision for sanitary improvements in the chief Cuban cities, Colonel Waring was put at the head of the commission. He made a special study of the conditions in Havana with a view of suggesting plans for perfecting the sanitary arrangements of the city and cleaning out the harbor, plans which, if they are carried out, would tend to mitigate the ravages of the dreaded yellow fever.

American Water Pipe Abroad.

The subject of American water pipes is creating considerable interest in Glasgow. An order for 1,000 tons of pipe has been given to a Philadelphia concern, in the face of determined opposition. In the first place, the American firm offered to do the work for $24,825, against $28,205, which was the next lowest Scotch bid. The fact that the American pipe was 12 feet long, instead of the 9-foot lengths usual in England, was made the ground for new bidding. The same American firm reduced its bid about $366, and the Scotch firm reduced its offer $3,410, but the American bid was still the lowest, and it was then proposed to give the order to the home firm, because it had a testing machine which could be used. Some members of the City Council objected to this unfairness, and the Scotch firm was given the small pipe. The offer was refused by the firm at the price named, and the American company received the entire contract.

London Engineering says that the Scotch makers have probably not heard the last of American pipe.

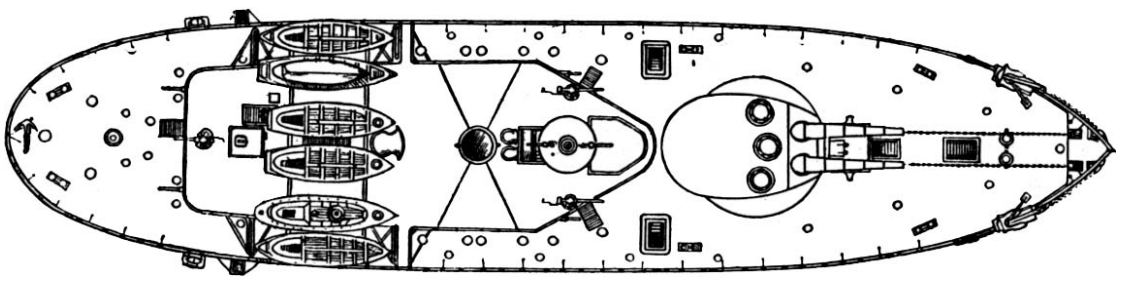
Quarters for Torpedo Boats.

Arrangements have now been made to lay up for the winter the eight torpedo boats which have been in active service during the war. They will be hauled entirely out of water and stored, after some repairs are made, in the New York navy yard. One hundred and fifty thousand dollars have been appropriated for the building of sheds at the Boston navy yard for this purpose, and plans and specifications are now being drawn up.

THE PROPOSED NEW MONITORS.

Following upon the provision of the Act of Congress approved May 4 of the present year, bids were opened at the Navy Department, on the 1st of October, for the construction of four harbor-defense vessels of the monitor type. The bids accepted ranged from $825,000 up to $875,000 for the construction of single vessels, and the awards, accordingly, were made one each to the Newport News Shipbuilding and Dry Dock Company, of Newport News, Va., to the Bath Iron Works, of Bath, Me., to Lewis Nixon, of Elizabethport, N. J., and to the Union Iron Works, of San Francisco. Twenty-seven months was the maximum time for completion set by the bidders.

As the result, however, of Admiral Sampson's report on the naval operations in the West Indies (see current issue of the SUPPLEMENT), in which he criticises severely the monitor type, the Navy Department has decided to revoke the contracts for the construction of these vessels, and has directed the Bureau of Construction to prepare plans for an improved type of monitor in which the defects of the present designs will be remedied. We give herewith drawings and a description of the first designs, now rejected, and in due course will furnish our readers with views of the amended designs.



DECK PLAN OF THE "ARKANSAS."

The "Arkansas" (the other three monitors are to be known as the "Connecticut," "Florida," and "Wyoming") has a waterline length of 225 feet. The vessels will be built upon the plans of the Navy Department, and a description of one applies equally to all the others; so, for example, we shall take the "Arkansas:"

The waterline length is 225 feet, the stem being carried well forward below the water and formed into a powerful ram; maximum beam, 50 feet; and draught upon normal displacement, 2,700 tons, 12½ feet. This shallow draught was adopted with a view to work around the Gulf and about the West Indies and some of our other Southern ports now denied to all but the lightest of our cruisers. Upon normal displacement the ship carries, loosely stowed in the bunkers, something like two hundred tons of coal.

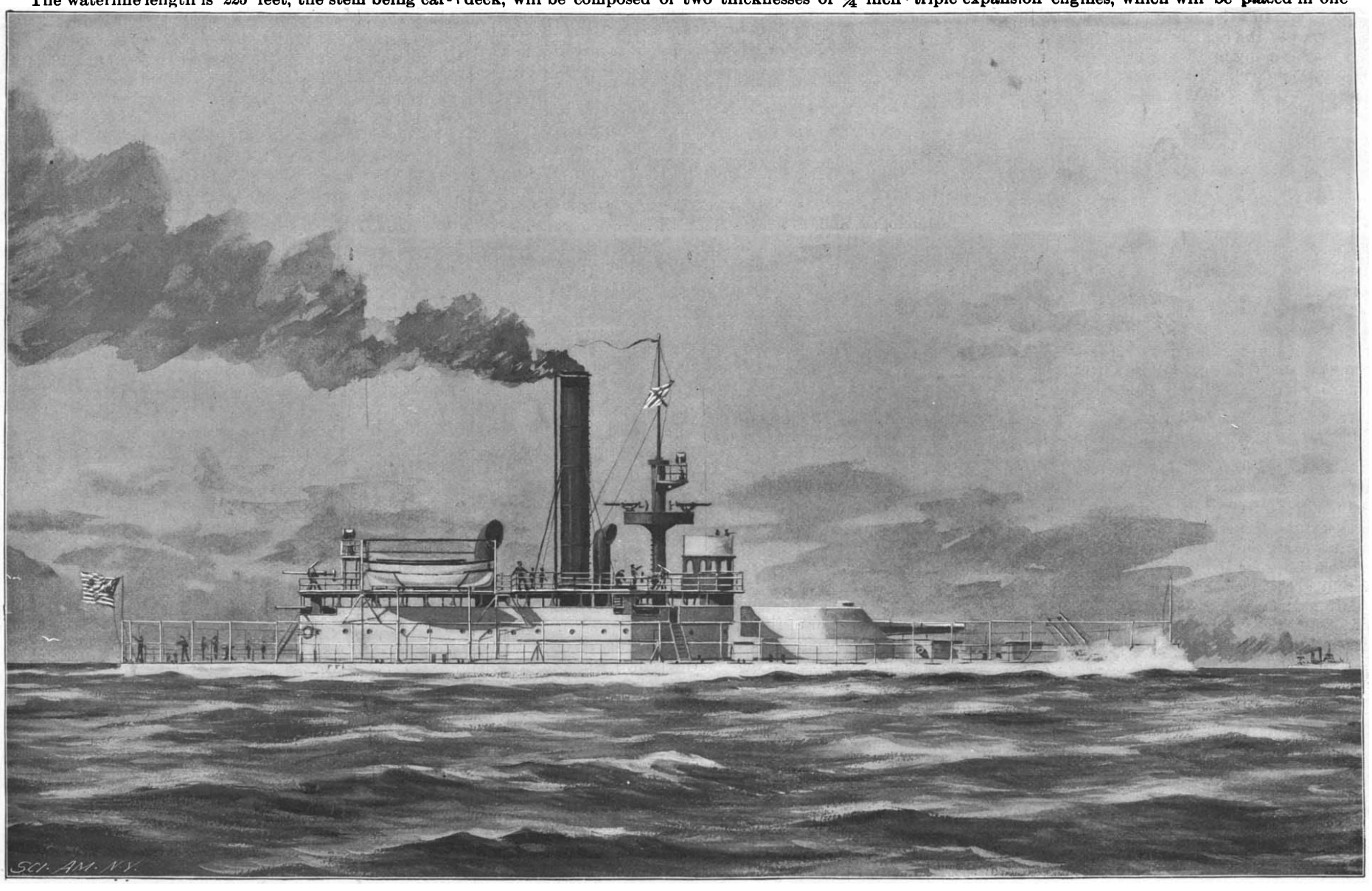
The hull is of steel, unsheathed, with an inner bottom reaching up to the armor shelf and ranging fore and aft throughout nearly the whole length of the ship. This intramural space is extensively subdivided into water-tight compartments, and, like the large, main compartments of the ship proper, it is under the control of a pumping plant of large capacity. The double bottom space just about the boilers is designed to carry feed water, rather a departure from the practice heretofore insisted upon by the department, thereby leaving the room ordinarily required for tanks to be put to more advantageous ends.

The hull is guarded by a continuous band of armor extending from the main deck line down to a maximum depth of thirty inches below the waterline amidships, but reaching only down to the water at the stern. This armor has a maximum thickness of eleven inches at the deck line throughout the region occupied by the engines, the boilers, and the magazines, tapering thence to the armor shelf well below water. Forward and abaft the "vital" space the armor is graduated by easy steps till it terminates at the bow and the stern in thicknesses of five inches. It was the intention of the department to have this armor treated by the Krupp hardening process, which is really the Harvey process carried farther into the plate; and if this be so, the defensive properties of the steel would be considerably increased, perhaps as much as twenty per cent. The protective deck, or more properly the main deck, will be composed of two thicknesses of ¾ inch plating, of which the upper course is of nickel steel. This is sufficient defense against the acute angle at which most plunging shots would have to strike. This main deck is planked, but, being exposed to the weather, will not be fireproofed.

A five-sided superstructure occupies the central portion of the main deck. In the lower half are quartered some of the officers, and there too is the galley, the armory, some wash rooms, and spare space for the housing of part of the crew if so desired. On the next deck above, i. e., the superstructure deck, is placed the major part of the rapid-fire portion of the battery. The hammock berthing is also in the superstructure on that deck, lending a very mild protection to the gun crews of some of the smaller pieces. On the bridge or uppermost deck are carried the chart house, the boats, and all of the 6-pounder rifles. This and the deck just below, like the main deck, being exposed to the weather, are not fireproofed; but the berth deck being under cover is covered with linoleum placed right upon the fundamental plating. Wherever possible, woodwork is omitted and supplanted by light metal bulwarks, etc., but where found needful for the sake of health and the saving of weight, the wood used is carefully fireproofed.

All hatch coamings are raised well above the main deck line, and those in the open forward are carried high enough to permit of their being left open even when the deck forward is well awash with broken seas. By this means the crew space forward on the berth deck is well lighted and comfortably ventilated when cruising in fair weather, a desideratum of prime importance when doing duty in warm Southern waters. In heavy weather these hatches would be battened down, and the fresh air supply would then be drawn down through the mast and the big ventilators, while a good deal of the foul air of the boiler spaces, especially, would be carried up between the double casings of the smokestack. The monitor is not naturally a cool craft when under steam, but everything has been done in the ships that could be done to make them much more comfortable than any of their predecessors. Electric fans and electrically propelled blowers furnish most of the induced ventilation.

The ship is driven by twin screws actuated by two triple expansion engines, which will be placed in one watertight compartment. These engines will be of the vertical, inverted cylinder, direct-acting type, each with a high pressure cylinder of 17 inches, an intermediate pressure cylinder of 26¼ inches, and a low pressure cylinder of 40 inches, the stroke of all pistons being two feet. The collective indicated horse power of the propelling and the circulating pump engines will be 2,400 when the main engines are making in the neighborhood of 200 revolutions per minute. Steam is supplied, at a working pressure of 250 pounds, by four water tube boilers, having a total grate surface of quite 200 square feet and a total heating surface of 8,800 square feet, and capable of supplying all the steam on shipboard when running at full power.



From a drawing by R. G. Skerrett.

PROPOSED MONITOR "ARKANSAS." ALSO "CONNECTICUT," "FLORIDA," AND "WYOMING."

Displacement, 2,700 tons. Speed, 12 knots. Coal Supply, 200 tons. Complement, 137. Armor: Belt, 11 inches to 5 inches; deck, 1½ inches; barbette, 11 inches; turret, 11 inches; conning tower, 7½ inches. Armament: Main battery, two 12-inch (new pattern); secondary battery, four 4-inch rapid-fire; auxiliary battery, three 6-pounders, four automatic 1-pounders. Authorized 1898.

The vessel is lighted by electricity, while the turret mechanisms and all the ammunition hoists will be actuated by the same energy. By the adoption of electricity so generally, the presence of long passages of heating steam pipes is obviated, and in this way alone a very considerable reduction of temperature will be effected under service conditions.

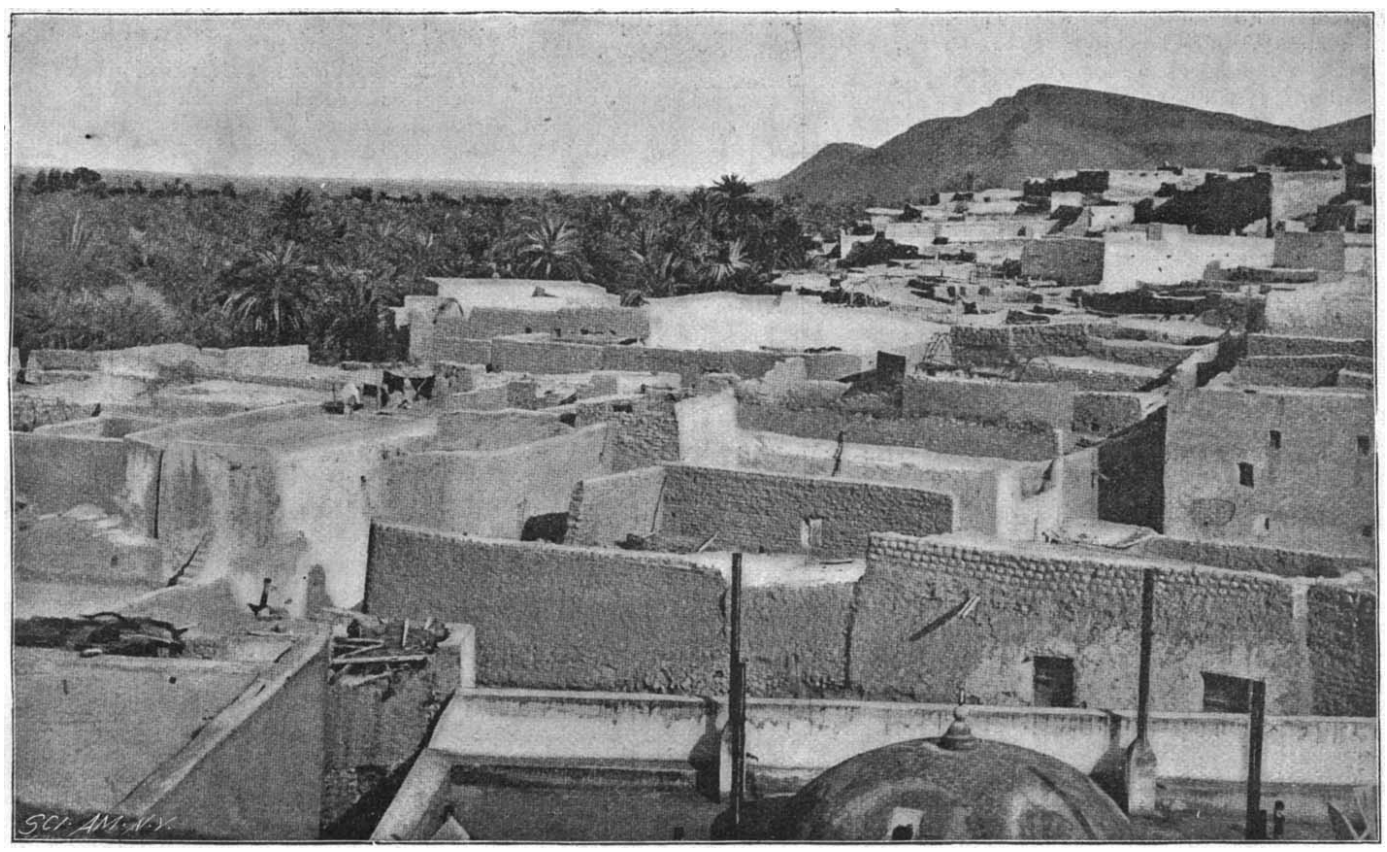
The main battery consists of two 12-inch breech-loading rifles, and the secondary battery of four 4-inch rifles, while the auxiliary battery includes three 6-pounders and four automatic 1-pounders.

The 12-inch guns are mounted in a single barbette turret of the balanced type, having an inclined face with a pitch of 42 degrees. The armor for the turret and the barbette is 11 inches thick and treated by the Krupp process. The four 4-inch guns are mounted on the four principal corners of the superstructure deck, where they will command an enviable field of fire. These guns are protected by shields. The 6-pounders are mounted on the bridge deck, while the 1-pounders are placed on the hammock berthing, amidships, and up in the single top of the military mast. The 12-inch and the 4-inch guns are to be designed for smokeless powder, and it is promised that they shall be a considerable advance upon the pieces of like caliber, of native design, now in service.

The ship will carry two search-lights, one forward on the mast and the other upon a stand at the after end of the bridge deck. Every modern facility will add to the equipment and finish of the vessel, and ample quarters and bathing facilities will make life reasonably comfortable for the complement of a captain, six other officers, and 130 enlisted men.

Docking keels are to be placed on the ship, and, acting somewhat in the capacity of bilge keels, will materially affect the steadiness of the craft in a seaway and add just that much more to her usefulness as a gun platform.

These four vessels have been designed to a large extent to meet the growing need of proper schools of instruction for the increasing ranks of the naval militia: and it is easy to see how successfully they meet the demand by covering every practical branch of naval warfare with the single exception of torpedo duty.



THE OASIS OF BOU-SAADA, PEARL OF THE ALGERIAN DESERT.

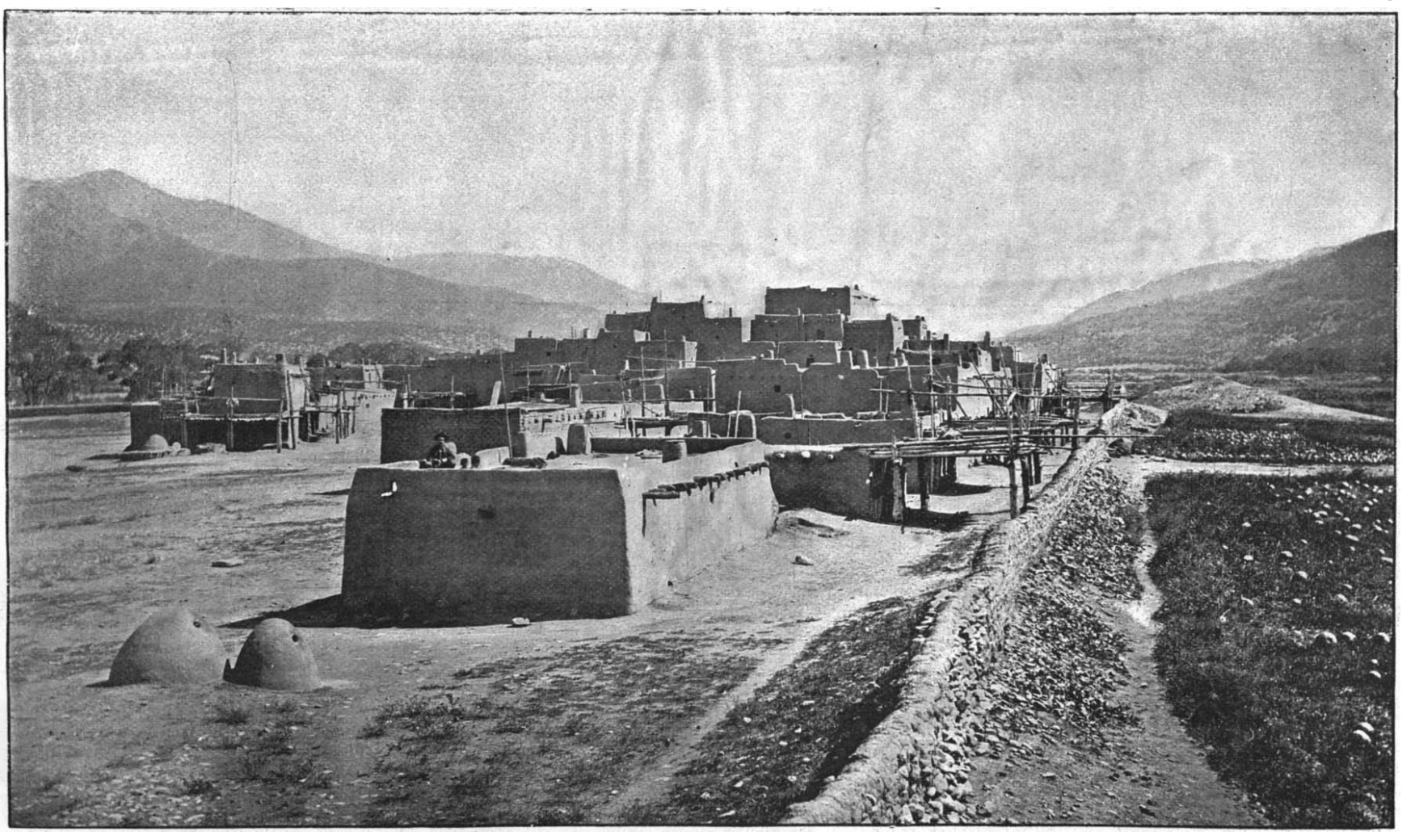
NATIVE ARCHITECTURE IN AFRICA AND NEW MEXICO.

BY COSMOS MINDELEFF.

Perhaps the most difficult problems with which the ethnologist, and, to a less extent, the archæologist, has to deal are those concerning the origin of the art products and of the ideas which are the subject of his study. The first question is, Was this art imported or is it indigenous to the tribe or people who practice it? The similarity of art products is often so close that an incautious student will at once pronounce them the same, that one tribe has taken the art direct from the other, but, on the other hand, it has been well established that arts so closely resembling each other as to be hardly distinguishable can and have been produced merely by similarity of conditions under which they developed. This peculiarity of primitive art has been discussed by the Director of the Bureau of Ethnology, J. W. Powell, under the title "Activital Similarities," and has attracted much attention from other anthropologists; but while many instances of imported arts are on record, evidence on the other side of the case is rare and difficult to procure.

Of all the arts of a primitive people, there is perhaps none which has the same value to the student as their architecture, for the reason that in their houses we find a record of their lives, of their manners and customs, of the conditions under which they lived, and, to a certain extent, even of their beliefs and hopes. Moreover, the record was made unconsciously, and generally with but little thought of the future, although often with a curious adherence to the ideas of the past. Thus, there is hardly a system of architecture, be it that of a primitive or of a civilized people, which does not carry within it evidence of the conditions under which it developed, and nothing is more common than architectural forms, originally derived from wooden construction, for example, afterward perpetuated in stone—a material to which they are not at all suited.

Much has been written about the houses of the Pueblo Indians of Arizona and New Mexico, the highest type of the house-building art found within the limits of the United States, and heretofore that system of architecture has been regarded as unique and the product of peculiar local conditions. There is no reason to doubt that it is indigenous to the country where it is found, but that similar conditions working upon a people who live much the same kind of life as that of the Pueblo Indians is shown by the illustrations and description of an Algerian village published in Le Monde Illustré by Eugène Gallois, a member of the



TIWA PUEBLO OF TAOS, NEW MEXICO, SHOWING RESEMBLANCE TO ARCHITECTURE OF ALGERIA.

Geographical Society of Paris. He devoted some time to the study of the oasis and village of Bou-Saada, and from his description the following is extracted:

Situated about 250 kilometers (150 miles) southeast of Algiers, the oasis of Bou-Saada, the pearl of Algeria, lies in a manner under the shadow of the mountains which close in the great plain of Hodna on the west. Framed in, as it were, the village, which has preserved all the characteristics of the Sahara, is placed on the last foothill of the mountain, just above some verdant gardens, watered by a spring which never dries up, a rare thing in Algeria, where generally the traveler finds only the dry and sandy beds of rivers.

The village has a native population of 45,000 Arabs, besides 5,500 of mixed and alien race. It was occupied in 1849 by a French expedition under Col. Daumas, and has been occupied ever since by a small garrison, but has preserved unchanged all its Arabian characteristics. The streets are narrow and bounded by walls pierced only here and there by low doors formed of the trunks of palm trees roughly squared and closed by great wooden bars. The houses are constructed of earth with terraced roofs, from which project the pieces of bamboo which serve as pipes to discharge the water which falls upon the flat roofs.

In the streets one passes now and then an Arab draped in his burnous, who returns his silent salutation, or an ass driven by a little child or perhaps bearing a man whose feet drag upon the ground as he rides. From the terraces the view is magnificent, extending far away to the horizon, while in the foreground are the gardens out of which the noble palms lift their heads. From the terraced roof of the mosque at sunset the muezzin calls his prayers, and is answered by his confreres from other parts of the village.

The buildings, the construction of which is very simple, consist of square or rectangular rooms, the ceilings of which, supported by wooden posts, are pierced by square holes or trap doors to permit the ingress of light and air and the egress of smoke. In the interior there is a modest assortment of household utensils, some wooden dishes, goat skins for water and perhaps some arms hung on the wall. In some of them there can still be seen primitive looms, for weaving is the principal industry of the country. In a corner is the ladder, more or less shaky, which leads to the terrace above.

This description might almost be applied to the Pueblo Indians and their houses, and the similarity, even in trifling details, is striking. The Pueblo country is in the heart of the "sub-arid" region, formerly known as the Great American Desert, and the villages are scattered here and there at such points as provide some facilities for horticulture or gardening, through the proximity of some large spring or small stream of water. The Algerian village was taken by the French in 1849, the Pueblo towns were acquired by conquest by the United States in 1846, so that both have been for about the same period in contact with a civilized people. Prior to the construction of the Atlantic and Pacific Railroad, about fifteen years ago, most Pueblo towns were as inaccessible as the village in the Sahara.

The distinctive feature of the Pueblo system of architecture, as may be seen from the illustration of the village of Taos, is the terraced arrangement of the flat roofed houses, which rise one above another like huge steps, sometimes to the height of seven stories. As in the Arabian village, access to the terraces is had by a ladder, which, oddly enough, is also more or less shaky, and always consists merely of two long poles into which rungs are loosely inserted. In order to prevent the contrivance from falling to pieces while in use, the lower ends of the poles are buried slightly in the ground, while the upper ends are held together by a cross piece of wood, or sometimes merely by a string. On the upper terraces access from one to another is often by means of narrow flights of stone steps, and the same feature can be seen in the illustration of the Algerian village.

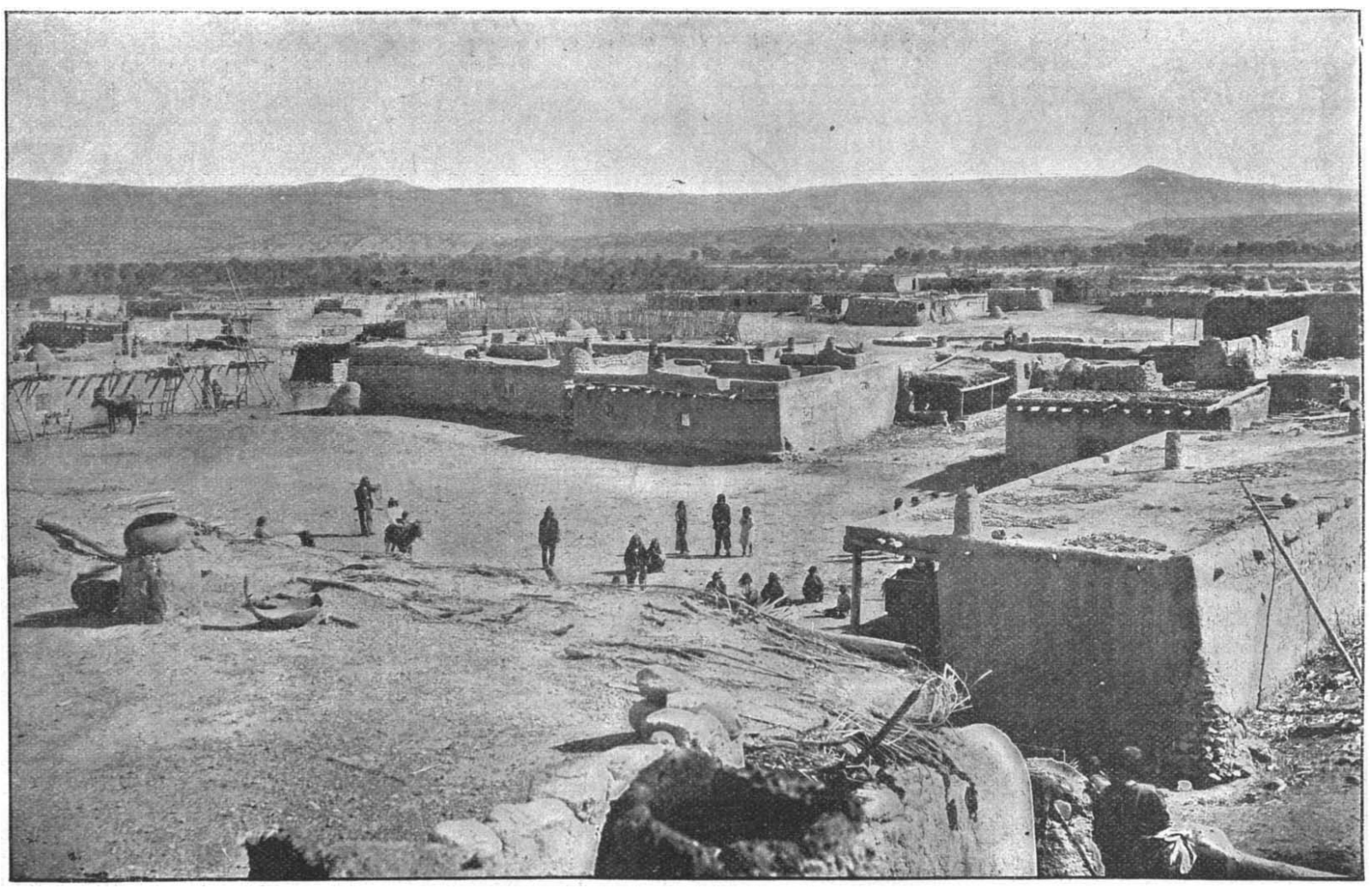
The Pueblo of Taos, the northernmost of all the villages, and second in size only to Zuñi, near the Arizona boundary, is in some respects the most interesting of all the Pueblo settlements, for it and Acoma, in New Mexico, with perhaps Oraibi, in Arizona, still remains on the site which it occupied at the time of the discovery and conquest of the country in 1540. All the other villages have been moved at least once, several of them several times in the past three and a half centuries. The place was then called Braba, or Yuraba, and was named by the Spaniards Valladolid. According to the ancient chronicler, "It has eighteen divisions; each one has a situation as if for two ground plots. The houses are very close together, and have five or six stories, . . . which become smaller as they go up, and each one has its little balcony outside of the mud walls, one above the other, all around, of wood."

At the present time the village consists of two main clusters of rooms or houses, each five or six stories in height. But the unit of the Pueblo system is the single cell, and the largest clusters are merely aggregations of many such cells. In other words, differentiation in form has not yet taken place, although differentiation in function necessarily followed the bringing together into one cluster of many rooms. The lower chambers and those in the interior of the huge beehive structure could only be used for storage, while the upper terraces and the outside rooms form the habitations of the people. When the conditions which produced the clustering are removed, as they have been in many cases, the houses spread out in very much the same way as those shown in the illustration of the Algerian village, where the terracing is confined to the more thickly settled portions of the settlement.

The bamboo drainage pipes of the Arabian village have almost exact counterparts in the Indian houses, formed of hollowed trunks of small trees, flat stones, or even gourds and pieces of crockery. In the Saharan settlement there are no chimneys, the only egress for smoke being a hole in the roof. In the Pueblo villages the same method formerly prevailed, and the trap doors in the roofs are still retained, although the chimney has been introduced through contact with the Spaniards and Mexicans, a contact which lasted for three hundred years prior to the American conquest of the country. In the older ruins, of which many hundreds are scattered over the country, no trace of a chimney has yet been found.

The streets in the Pueblo settlements are usually narrow, and under the old system no doorway or other large opening was ever made in the walls of the first or ground story. In recent years the old practice has been abandoned to some extent, and doorways almost identical in appearance with those of the Algerian houses can be seen in the newer houses. Formerly the openings were closed merely by a hanging blanket, but now rough doors are used, commonly closed by a heavy wooden bar.

The Arab in his burnous is not a bad imitation of the Pueblo Indian wrapped in his blanket, the one invariable and distinctive article of his costume. Oddly enough, too, the burro, or ass, is the beast of burden of both peoples, and in Arizona, as in Africa, is under the especial charge of the children. The fine and extensive view from the Arabian village is exactly paralleled by the outlook from any Pueblo town, and from every ruin, for such an outlook was and is regarded as an essential feature in the location of a settlement, if not indeed the most essential feature after proximity to some good area of cultivable land, or some fine spring. Close attention to this requirement is found even in the sites of cliff ruins and other subordinate structures. Singularly, also, among the Pueblos a practice prevails which is not unlike the muezzin's evening call to prayer. Every evening at sundown men ascend to the highest terraces and there call out the news of the day, at the same time making announcement of the programme for the morrow, and of any important dance or other religious ceremony to be performed in the near future.



KERES PUEBLO OF COCHITI.

In their interior arrangements the Indian homes closely resemble those described by the French explorer, even to the primitive looms, for among the Pueblos, as in the village of Bou-Saada, weaving is one of the principal industries of the people. In making the finest grades of blankets they have no equal, although in less perfect weaving, the Navajos, whose territory adjoins, are much larger producers.

The physical conditions in both countries are much alike. In both the want of water is the one great dominating feature, and among the Pueblos has dictated not only their manner of life, but also their beliefs. Their whole vast mythologic system revolves about that one idea. What effect this condition has had upon the mental life of the people of Bou-Saada, we do not know, but that it has dictated their manner of life and some at least of their arts is apparent. Separated as they are by a great ocean and by thousands of miles, the houses of the people are so closely similar that Bou-Saada might be transported to New Mexico, or the Pueblo of Taos to Africa, without doing violence to one's ideas of the eternal fitness of things.

For our engravings, made from photographs taken in New Mexico, we are indebted to the United States Bureau of Ethnology.

A WAVE-PROPELLED BOAT.

Our illustrations describe a novel construction of a wave impulse device attached to boats for producing motion, invented by H. F. L. Linden, secretary of the Zoological station at Naples, Italy. He explains how he came to discover it in these words:

"Frequent opportunities for observing the movement of fishes in aquaria, of dolphins at sea, induced me, several years ago, to begin a series of experiments for the purpose of turning to practical uses the principle of the swimming motion of fishes. After many experiments, I ascertained the following facts:

"If powerful, resilient floats be attached horizontally, obliquely or vertically, under the water-line of a floating body, for example a boat, in such a manner that the free ends of the floats (made of sheet steel or of other elastic material, or of some skeleton covered by a membrane, like the webbed feet of aquatic birds) are directed rearwardly, then the boat will move constantly and spontaneously onward through the waves, by reason of the impact of the water on the elastic floats, the operation of the latter corresponding essentially to the action of a fish's tail.

"The resistance encountered in the water by the floats, due either to the motion produced by the pitching and rolling of the boat or to the direct pressure produced by the impact of masses of water falling on the upper surfaces of the floats, causes these elastic floats to bend outwardly to a corresponding degree; but as soon as the waves have momentarily subsided, the floats spring back to their initial position. It is evident that the striking of the masses of water against the arched surfaces of the floats, as well as the exertion of force during the backward springing, gives rise to a force which is directed toward the fast ends of the floats and which drives the boat in the direction of this impulse. Thus, by means of a continuous motion of alternate arching and backward springing, the boat is put in motion, and, as already remarked, in a direction from the free to the fast end of the floats.

"The effect of the floats is the more pronounced as the motion of the waves is stronger and more frequent.

"Owing to the resistance encountered by the floats in the water, the pitching and rolling of the boat is materially reduced."

The direction of the boat's motion is therefore independent of the direction of the waves or of the wind, and depends only on the direction given to the spontaneously moving free ends of the floats. Thus, for example, if the free thin ends of the floats are directed forwardly, then the boat is driven rearwardly; if one half of the floats used be directed forwardly and the other half rearwardly, then the action of the floats ceases, and the boat stops. It follows, therefore, from the preceding, that by disposing the floats unsymmetrically, the effect of a rudder is obtained. The boat illustrated, however, is provided with an ordinary rudder, since the latter is more easily controlled.

A long series of experiments at sea has proved that the floats must arch themselves in approximately the same curves as the caudal fins of dolphins and other fishes.

"The accompanying diagram represents the boat which I used at sea during my experiments, and which has proved itself well adapted to my purpose. This little vessel is provided at both ends with watertight compartments. Her length is 4 meters (13·12 feet); her beam, 0·95 meter (3·12 feet); her depth, 0·50 meter (1·64 feet); and her displacement about 200 kilogrammes (440 pounds). The floats taken together weigh about 40 kilogrammes, (88 pounds), the forward float being at the bow or right hand end of the boat and the after float, formed in one piece with the rudder, being at the left hand end.

"After many experiments, it has proved simplest and most expedient to use only horizontal floats secured to the ends of the boat, because the pitching is greatest at these portions. I no longer use vertical floats, because they are to a marked degree less effective than horizontal floats. They are, moreover, difficult to handle, and being fastened to the keel, increase the draught of the boat, thus rendering landing difficult.

"In the type of boat illustrated the floats may be attached and removed with equal readiness. On account of the small size of the boat, I thought it unnecessary to make the after float adjustable forwardly.

"Each float is made of four hardened steel plates 50 centimeters (19·50 inches) in length; 25 centimeters (9·75 inches) in breadth; and 1·75 millimeters (0·068 inch) in thickness, thinning out to 0·25 millimeter (0·0098 inch) at the free ends.

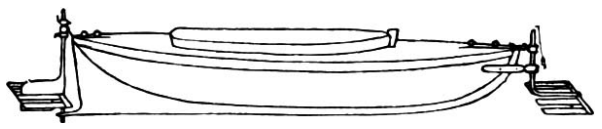
"The spaces between the plates can be spanned with smooth canvas, thus increasing the area of the upper surface of the floats from 1 square meter (about one-third of the surface in contact with the water when the boat is afloat) to about 1·25 square meters (13·455 square feet). The resiliency of the floats can be increased or decreased by means of steel tongues. Since the floats considerably reduce the rolling of the boat, I take but little ballast on board, even though the water be very rough. As a rule, the floats are placed at such a depth that, so long as the boat is afloat, they shall always be under water.

"Many experiments with different sized models have demonstrated that the speed is increased with the length of the boat, without a corresponding increase in the area of the upper surfaces of the floats. Floats of the size mentioned have been proved strong enough to propel boats of larger size than the one described. They were used last summer on a 5½ meter (18·04 foot) caique, which towed at the same time two smaller boats each 3 meters (9·84 feet) in length against the 'imbatto' or midday wind.

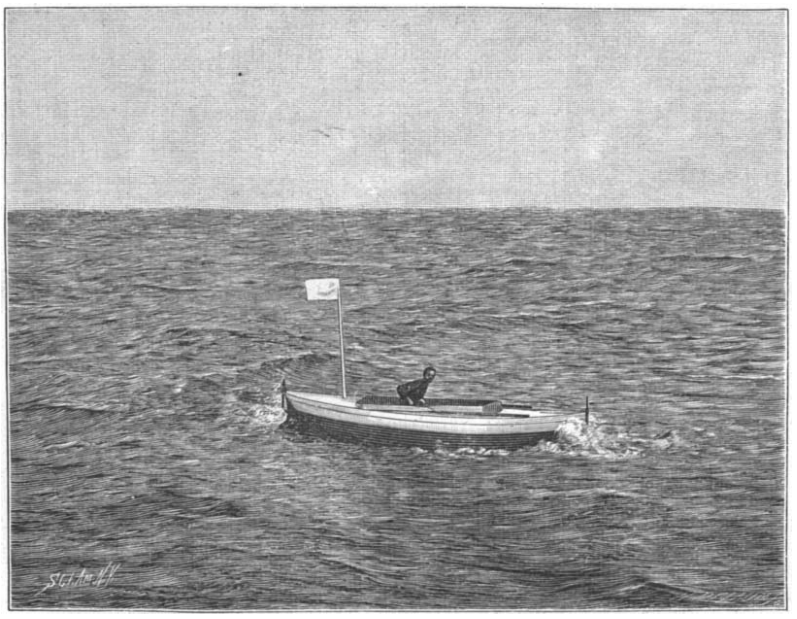
"It is a question of the future to what extent this type of motor can be practically used on larger vessels under various conditions, such as storm, calm with moving seas, etc."

A series of interesting experiments were made at the German fishery exhibition in Berlin not long ago on the river Spree, with small wave motor boats to be used to carry oil bags for spreading oil on the water surface in advance of the approach of larger fishing vessels, giving them smoother water to pass through.

It was found to be quite feasible, and the direction of these miniature oil-spreading boats or planks was regulated by having more weight on one side than the other, and also by the use of rigid thin metal flags inclined at varying angles to the axis of the boat. The boat should be comparatively heavy, in order that it may not be overturned by the high waves.



THE WAVE MOTOR BOAT AND PROPELLING FINS.



THE WAVE-PROPELLED BOAT—SPEED, 2½ MILES PER HOUR.

The larger engraving (reproduced from a photograph) shows a wave motor boat working against the waves and a south wind towing a 1½ inch plank nearly 5 feet long at a speed of about 2½ miles an hour; the white flag indicates the direction of the wind. It is certainly a very curious kind of power and a most interesting experiment.

How to Postpone Old Age.*

Anatomical experiment and investigation show that the chief characteristics of old age are the deposits of earthy matter of a gelatinous, fibrinous character in the human system. Carbonate and phosphate of lime, mixed with other salts of a calcareous nature, have been found to furnish the greater part of these earthy deposits. As observation shows, man begins in a gelatinous condition; he ends in an osseous or bony one—soft in infancy, hard in old age. By gradual change in the long space of years the ossification comes on; but, after middle life is passed, a more marked development of the ossific character takes place. Of course, these earthy deposits—which affect all the physical organs—naturally interfere with their functions. Partial ossification of the heart produces the imperfect circulation of the blood which affects the aged. When the arteries are clogged with calcareous matter, there is interference with circulation, upon which nutrition depends. Without nutrition there is no repair of the body. None of these things interfere with nutrition and circulation in earlier years. The reparation of the physical system, as everyone ought to know, depends on this fine balance. In fact, the whole change is merely a slow, steady accumulation of calcareous deposits in the system. . . . When these become excessive and resist expulsion, they cause the stiffness and dryness of old age. Entire blockage of the functions of the body is then a mere matter of time. The refuse matter deposited by the blood in its constant passage through the system stops the delicate and exquisite machinery which we call life. This is death. It has been proved by analysis that human blood contains compounds of lime, magnesia, and iron. In the blood itself are thus contained the earth salts. In early life they are thrown off. Age has not the power to do it.

Hence, as blood is produced by assimilation of the food we eat, to this food we must look for the earthy accumulations which in time block up the system and bring on old age. . . . Almost everything we eat contains more or less of these elements for destroying life, by means of calcareous salts deposited by the all-nourishing blood. Careful selection, however, can enable us to avoid the worst of them. Earth salts abound in the cereals, and bread itself, though seemingly the most innocent of edibles, greatly assists in the deposition of calcareous matter in our bodies. Nitrogenous food abounds in this element. Hence a diet made up of fruit principally is best for people advancing in years, for the reason that, being deficient in nitrogen, the ossific deposits so much to be dreaded are more likely to be suspended. Moderate eaters have in all cases a much better chance for long life than those addicted to excesses of the table. Fruits, fish, poultry, young mutton, and veal contain less of the earthy salts than other articles of food, and are therefore best for people entering the vale of years. Beef and old mutton usually are overcharged with salts, and should be avoided; a diet containing a minimum amount of earthy particles is most suitable to retard old age, by preserving the system from functional blockages. . . . The daily use of distilled water is, after middle life, one of the most important means of preventing secretions and the derangement of health. As to diluted phosphoric acid, it is one of the most powerful influences known to science for shielding the human system from the inconveniences of old age. Daily use of it mixed with distilled water helps to retard the approach of senility. By its affinity for oxygen the fibrinous and gelatinous deposits previously alluded to are checked, and their expulsion from the system hastened.

To sum up: Avoid all foods rich in the earth soils, use much fruit, especially juicy, uncooked apples, and take daily two or three tumblerfuls of distilled water with about ten or fifteen drops of diluted phosphoric acid in each glassful. Thus will our days be prolonged, old age delayed, and health insured.

* Dr. W. Kinnear, in The Humanitarian.

The Current Supplement.

The current SUPPLEMENT, No. 1193, is of extraordinary interest. The first article is "The Paris Opera House," which contains views of the façade of the Opera House, a full page view of the grand staircase, and longitudinal sections through the entire building, showing the location of all the various rooms in the entire building. "The German Maneuver Fleet in a Storm on the Baltic Sea" is a spirited full page engraving. "Official Report on the Naval Operations in the West Indies" is an elaborate article prepared from an advance copy of Admiral Sampson's report. It contains many items of interest which will appeal to all naval men and to those who have closely followed the operations of the fleet. The report is in the form of a running diary of events which took place from May 4 to July 2, so that it gives a résumé of the anxious work of almost two months which culminated in the total destruction of the squadron of Admiral Cervera. The article is accompanied by an elaborate chart showing the movement of the North Atlantic Squadron, the Flying Squadron, and the squadron of Admiral Cervera; the order of cruising, the first, second, and third orders of battle, and the day and night formation are also given This article is a most important and interesting one, and we feel sure it will be welcomed by our readers. Among the other articles are "Anthropology," the first address by E. W. Brabrook read before a meeting of the British Association. "The Dignity of Analytical Work" is the presidential address of C. B. Dudley, delivered at the Washington meeting of the American Chemical Society.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

PLOW.—CARLO O. DAHLMAN, Chicago, Ill. Briefly stated, this plow embodies in its construction a moldboard having an endless belt traveling over its turning-face which, in the forward movement of the plow, carries the earth rearwardly, whereby the friction of the earth is decreased, and the moldboard is kept scoured. Suitable guards are also provided for guiding the upper and lower edges of the belt.

Engineering Improvements.

STEAM-ENGINE.—LOUIS DALLA-DECIMAS, Courbevoie, ADOLPHE KECHEUR, Billancourt, and AUGUSTE CHAGNAUD, Cognac, France. This invention provides an engine having three cylinders arranged radially about a common central chamber, each cylinder having two passages leading respectively from its inner to its outer end. A valve controls each of the passages. To pistons in the cylinders, piston-rods are rigidly secured, so as to have a rectilinear reciprocating motion. Each of the pistons carries at its outer end a head provided with a transverse slideway, engaged by the crank-pins of rotatable pinions. A gear-wheel rotates upon the axis from which the cylinders radiate, and engages the pinions. The rotation of the gear-wheel controls the motion of the valves.

Mechanical Devices.

DADOING AND TENONING MACHINE.—ALOIS KOHLER, New York city. The purpose of this invention is to provide an improved machine by means of which certain parts of the framing for door and window casings may be cheaply and rapidly produced. The apparatus consists of a frame slidable upon the main frame of the machine and carrying two shafts, one provided with the dado-heads and with a cut-off saw between the heads, and the other provided with the tenoning heads. The frame can be moved toward and away from the stock placed upon the working-table. The device constitutes a compact and easily operated machine, which may be so set, that accuracy and uniformity of the work may be attained with the use of ordinary labor.

WAVE-MOTOR.—JOHN W. PITTS, Hueneme, Cal. This invention provides a wave-motor having a float or buoyant vessel containing gearing and a frame hung from a mast attached to the gearing, so that the diversities of movement occurring between the frame and the vessel will be transmitted to the gearing in a manner adapted for practical use.

Railway Appliances.

AIR-BRAKE.—WILLIAM T. HAMAR, Atlanta, Ga. This invention provides an improvement in the main piston of the triple valve of an automatic air-brake system, used for the purpose of passing air from a train-pipe to the auxiliary air-reservoir located on the car in the position of "brakes applied." The invention provides means for recharging the auxiliary air-reservoir while the brakes are still applied or before the air is discharged from the brake-cylinder, so that the auxiliary air-reservoir is ready to perform its full and effective work at its normal pressure in a second application of the brakes, immediately after the brakes are taken off.

AUTOMATIC SIGNALING MECHANISM FOR LOCOMOTIVES.—MASON A. BAMBOROUGH, Chicago, Ill. The object of this invention is to provide a signaling mechanism for locomotive engines, which is designed to sound automatically the whistle or gong, as may be desired, at or near stations, crossings, switches, or other places. In connection with the locomotive whistle or bell, a rod is connected which extends downwardly. A lever is transversely arranged beneath the locomotive and engages the rod. A lever-arm, jointed to and swinging freely from the outer end of the lever, is adapted to engage a trip-block alongside the track, so as to operate the whistle or gong.

Miscellaneous Inventions.

BOTTLE-STOPPER.—URIAH L. RIFE, Newport, R. I. This bottle-stopper has a plug adapted to engage the end of a bottle-neck. A metal sleeve depends from the plug and has a number of longitudinal slits forming fingers. A bushing of yielding material surrounds the sleeve, the sleeve being extended the entire length of the bushing so as to prevent buckling. A stem movable through the plug has a bulb at its lower end to expand the sleeve, a head on its outer end, and a spring between the head and the plug.

CRATE.—EDWARD S. SHELLHOUSE, Carey, O. The folding crate provided by this inventor has a base composed of parts rigidly connected, with sockets interiorly located at the corners. An upper folding section having side pieces is also provided and has a hinged connection with the corresponding parts of the base-section. End pieces are adapted to rest upon the end portions of the base-section, and have corner-posts arranged to enter the sockets in the base. The corner-posts are formed with ledges on their upper ends, upon which ledges a covering-piece is adapted to rest. This covering-piece is provided with a door. Locking-devices connect the side-pieces of the upper section with the end-pieces of the upper section.

JAR-CLOSURE.—JOHN SCHIES, Anderson, Ind. This invention aims to provide a simple and novel form of fastener and of stopper, together with a mouth and neck conformed to and co-operating therewith, by which a secure and tight closure is effected, the whole presenting an attractive appearance. By employing a clamping bar or rod of especial construction, the stopper may be held firmly in the mouth of the jar and may, with equal readiness, be removed.

PACKING FOR PUMP-PISTONS.—FREDERICK VAN DEN POSCH, Parker's Landing, Pa. The inventor claims that his packing possesses the elasticity of a leather cup without becoming soft in oil or hard in salt water. The packing in question consists of a body formed of fibrous material, and of a base-ring made of vulcanized rubber united with the lower edge of this fibrous body and possessing greater rigidity than the latter.

ANNEALING-POT.—WILLIAM P. DOULIN and FRANCIS W. RAYMOND, Wheeling, W. Va. To overcome the deterioration due to the expansion and contraction caused by the successive heating and cooling of tin-plates while being annealed, these inventors have connected with the body of the annealing-pot, flanged near its interior edge, a removable top composed of sections suitably connected, and an arched top brace having a dovetail slide detachably connected with two of the sections. By constructing the pot in detachable removable sections, expansion and contraction, it is claimed, are so neutralized that twisting and cracking are prevented.

HARNESS-LOOP.—JOHN T. CONDON, Lemars, Ia. The device of this inventor is an improvement in the class of skeleton metal loops which are applied to various portions of harness, more especially to neck-yoke, breast, hame, and breeching straps, for the purpose of securing the ends of the straps at points contiguous with the buckles. The loop comprises obtuse-angled side bars, having pendant ears and four connecting bars, one being curved inwardly. The middle of the three bars is located in rear of the bottom one and confines the loop of the strap. The front bar is curved to accommodate the buckle-tongue, its ends being in contact with the buckle-frame.

DRAFT-CLEVIS FOR PLOWS.—STACY H. SNOWDEN, Arcturus, Va. By means of the improvements embodied in this draft-clevis for plows, the inventor is enabled to regulate the amount of land cut by the plow, and to secure a regulation of the depth of a plow when in operation. The clevis has a latch provided with a notched wing and with a stop-wing at an angle thereto. A draft connection is provided consisting of two hooks swiveled together, one of the hooks being adapted to be secured in different engagements with the clevis, by means of the notched wing; and the other hook being adapted for connection with the whiffletree. By adjusting the swiveled hook, the plow may be made to sink more deeply or to exert a greater lateral force.

CORE FOR PAPER ROLLS.—JOHN J. MORAN and SIDNEY E. SMITH, New York city. This invention provides a core for rolled paper, such as that which is used in printing-presses. The core is made collapsible or capable of being removed from the roll of paper after it has been wound, thereby avoiding the necessity of shipping cores in the rolls and returning the cores to the mill after the paper has been used, and also obviating the expense of procuring cores sufficient to supply the needs of the mill while other cores are in transit or held at the printing-office.

BEDSTEAD.—BENJAMIN F. BAILEY, Ellisville, Miss. By means of the durable support provided by this inventor, bed-slats may be conveniently attached to the side rails of a bedstead, the support for the slats being of such character that it will not harbor vermin and will add materially to the strength of the rails. Tips are provided for the ends of the slats, which tips are adapted for engagement with the supports on the side rails. When placed in position, the slats serve to tie the side rails together wherever a slat is placed, thus adding to the strength of the bedstead.

CARPET-BEATER.—CHARLES M. COMSTOCK, Windsor, N. Y. This carpet-beater consists of a handle having a cylindrical section provided with longitudinal grooves in opposing faces, the grooves having inclined lower faces. The end portions of a rattan bow engage with the grooved surfaces of the handle extension. Clamping-sleeves conforming with the shape of the extension of the handle and with the outer formation of the members of the bow, are also provided. These sleeves receive the members of the bow and are passed over the extension portion of the handle. By this means the members of the bow will be subjected to a wedge-like action to clamp them firmly to the handle extension, thus providing a secure fastening for the rattan.

PROTECTOR.—HOWARD K. FOLLANSBEE, Wellington, O. This invention provides an improved protector especially designed for use in an ordinary vest-pocket to keep the walls thereof spread apart to permit the protection and reception of cigars. When closed, the device forms a casing for a single cigar or other article. The protector consists principally of two oppositely arranged members and a folding device to connect the members with each other and close them so as to form either a casing or a means whereby the members are spread apart.

CIGAR-LIGHTER.—AUGUSTUS C. GRUHLKE, Waterloo, Ind. In this invention a cigar-lighter is provided, which is suspended from the ceiling so as to hang near a show-case. The lighter in question is automatically enkindled by an electric spark when drawn toward the person desiring to use the device; is automatically extinguished when released; and is so constructed that the electric current cannot be short-circuited.

HAIR-FASTENER.—SETH W. HERRICK and CALEB R. LUNGER, London, England. Hither the duplex combs employed in hair-dressing have been permanently riveted or hinged to each other. These constructions have the disadvantage of permitting only a small degree of separation at the jointed sides. Difficulty is also experienced in placing the comb exactly upright after folding the hinged portions together. These objections are overcome in the present invention, by providing a comb consisting substantially of two entirely separable combs, so designed as to be capable of interlocking. One of the combs is provided for this purpose with guideways extending longitudinally of the teeth, the other comb having blades or prongs adapted to enter these guideways.

TIME-OPERATING VALVE.—THOMAS KITSON, Stroudsburg, Pa. This valve is particularly adapted to the controlling of the dampers and doors of stoves, and is connected with an alarm-clock, so that, as the alarm is sounded, mechanical devices are operated to release a chain or other connection. A circular backplate is adapted to be attached to the clock and has an annular flange at its edge projecting from one face to engage with the clock. A lug attached to the plate projects from a break in the flange and acts as the fulcrum of a lever having one arm projected through the break in the flange and lying alongside of the inner face of the plate. An arm rigid with the plate projects outwardly therefrom adjacent to the lug. A finger is pivoted to the arm and is engaged with the outer end of the lever. By this means the finger is held until the lever is thrown.

HAND-STAMP.—CALEB LEE, Homeworth, O. The purpose of this invention is to provide a stamp designed for use in post-offices, business-houses, and the like. The device comprises a revoluble inking-pad mounted yieldingly, a platen arranged adjacently to the inking-pad, a revoluble stamp-carrier holding a number of stamps, and controlling the movement of the inking-pad, a spring-pressed shaft formed with a spiral groove and mounted to turn and to slide, and a spring-pressed pawl engaging the groove to turn the shaft on its return movement.

COMPRESSED-AIR WATER-ELEVATOR.—WILLIAM A. MITCHELL, Nashville, Tenn. The water-elevator forming the subject of this invention is so constructed, that water may be supplied from a cistern to any point in a building or to any point removed from the source of supply, it being possible to discharge any water that may be in the pipes, and to refill the pipes quickly with fresh water, thus obviating the necessity of using water that may have become stale by stagnation. A self-filling water-cylinder is provided which is placed in the source of water-supply. A return-pipe is connected with the service-pipe and with the cistern or source of water-supply, and is adapted to conduct water from the service-pipe into the cistern in such a manner, that the water delivered by the return-pipe, together with any air that may be within the return-pipe, will agitate and purify the water in the cistern, fresh cool water, as previously stated, simultaneously entering the service-pipes from the cistern.

FILTER.—ALBERT L. MCLANE, Laredo, Tex. With a basin, a series of filters are connected, each having porous walls and chambers. Each of the filters has a valve controlled connection with a discharge-pipe. A flushing or service-pipe is provided with which each of the filters has a valve-controlled connection. In operation the basin is filled and the several filters are entirely submerged. The water will percolate through the porous material and will then be discharged from chambers into the main-pipe.

TYPE-WRITER CABINET.—PHILIP E. WHITING, Carmi, Ill. This inventor has devised a cabinet in which several compartments are provided for the machine and for supplies. These compartments have doors, which are connected with one another, and with a drawer that supports the type-writer. When the drawer is pulled out, the type-writer compartment and the supply-compartments are opened. The compartments are closed by pushing the drawer in.

Designs.

TIP-CAT.—ROBERT A. NAGLER, New York city. The tip-cat of this inventor differs from most others in being made of elastic rubber, whereby the cat, upon being struck upon one of its pointed ends, will bound to a greater height and distance than is usual in wooden cats. The sides of this rubber cat are hollowed to enable it to be readily picked up.

BADGE.—LAHVESIA P. C. LOCKWOOD, Lake Maitland, Fla. The leading feature of this design consists in two plates, one pendent from the other. Upon one plate a pig is drawn; upon the other plate a man is pictured in a kneeling position. The design represents figuratively. Spain begging peace from the United States.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for 10 cents each. Please send the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

A SHORT MANUAL OF ANALYTICAL CHEMISTRY: QUALITATIVE, QUANTITATIVE, INORGANIC AND ORGANIC. By John Muter, Ph.D. Philadelphia: P. Blakiston, Son & Company. 1898. Pp. 228. 8vo. Illustrated. Price $1.25.

The present manual is the second American edition adapted from the eighth British edition, which shows that the book has been received with great favor. It is designed to introduce students to the chief developments of analytical chemistry, from the simplest operations upward, and including many organic questions generally overlooked in elementary books. By working through it a student will become familiar with a great variety of processes, and will then be in a position to use with satisfaction the exhaustive treatises dealing with any special branch he may wish to follow. The book is illustrated and is accompanied by a large number of analytical tables.

A TEXT BOOK OF MINERALOGY. With an Extended Treatise on Crystallography and Physical Mineralogy. By Edward S. Dana. New York: J. Wiley & Sons. 1898. Pp. 593. 8vo. 1,000 illustrations. Price $4.

The "Text Book" is a very old friend and has always maintained the reputation of being one of the best and the most usable books ever published on the subject in any language. The remarkable advance in the science of mineralogy during the years that have elapsed since the "Text Book" was first issued in 1877 has made it necessary in the preparation of a new edition to rewrite the whole, as well as to add much new matter and many illustrations. All who are in any way interested in mineralogy cannot fail to receive a vast amount of information from this book. It is a standard reference book which we keep on our table to settle all questions of mineralogy. We know of no book on the subject in the English language which is so thoroughly good. It is, perhaps, too advanced for the beginner, but fortunately the Danas have three books, in which the subject is carefully graded. The present volume might be called the intermediate one.

PROCEEDINGS OF THE FIFTEENTH ANNUAL CONVENTION OF THE NATIONAL CONFECTIONERS' ASSOCIATION OF THE UNITED STATES. Held at Chicago, Ill., June 1 and 2, 1898. Official Records of Reports, Circulars, and Communications for the year 1897-1898. Philadelphia: Confectioners' Journal. 1898. Pp. 279.

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